AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS PATTERN MAKERS AND BLACKSMITHS.

VOL. I. NO. 2.] NEW YORK, DECEMBER, 1877. [$1.50 PER ANNUM.

Plate Shearing Machine.

In modern bridge construction and in shipbuilding the want of a machine to trim the edges of long plates and to cut off to length wide plates, has been severely felt, and to fill such a want the machine, of which an illustration is made, was designed.

The machine is of very rigid construction, and will shear a plate 1 inch thick 5 feet wide. The upper blade is guided vertically in the frame of the machine, and is driven down by a pitman as wide as the blade is long; this pitman receiving motion from a long, rocking shaft above. The driving arm or lever of the machine is a rack segment, engaging with the teeth of a spiral pinion similar to the pinion used in the well-known planer manufactured by the same firm. This pinion is peculiar, and is, in fact, a short piece of a coarse screw, the position of the teeth upon the same being as the threads of a screw of a deep pitch and of a like number of threads to that of teeth in the pinion. It is a mistake to suppose that this pinion, like a worm, must run in oil; in fact such a condition would be injurious, as the oil would be thrown off by the revolutions, and become a serious nuisance.

This pinion is driven in turn by a bevel wheel and pinion, with open and cross belts, also similar in arrangement to the planer made by this firm. The belt shifting motion being provided with an automatic adjustment, gauging the length of shear stroke.

The plate clamped to place can be sheared with exceeding exactness, either in trimming the edge of long plates or cutting off plates 5 feet wide and under to length. The blade being at all times under the control of the operator, can be made to cut to any fixed point of its length, and then stopped or raised. A hand rod in front of the machine is convenient to shift the belts and start the cut; it makes a down stroke, immediately reascends and stops up to wait for the readjustment of the plate.

The machine is so constructed as to have its strains all within itself, and is not in any great measure dependent upon stone foundation for its rigidity other than the proper maintaining of the structure in a level position. The vertical slide is arranged to receive curved blades, and the bed plate, to which the lower blade is attached, is capable of ready removal to receive a curved bed plate with a shear to match the curve in the upper blade. One of these machines was exhibited at the Centennial Exhibition and attracted the attention of mechanics by the novelty and efficiency of the driving device as well as the general excellence of details and construction.

The machine so exhibited is now being used at one of our large bridge building establishments. It was made by the well-known firm of Wm. Sellers & Co., Philadelphia.

Only one machine of this kind has been built, and its perfect adaptability to the work required of it exhibits a high order of inventive and constructive skill. The above firm are noted throughout the world for the excellency and originality of their machinery.

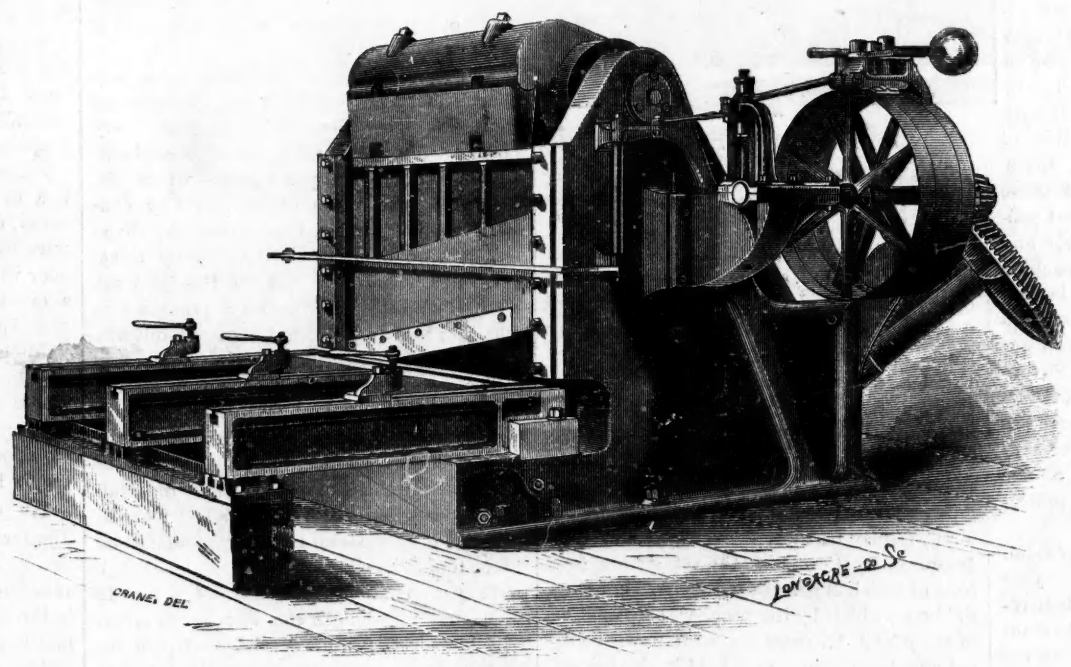


PLATE SHEARING MACHINE.

Pumping Engines.

The following is an extract from the general report on the Hydraulic Exhibits at the International Exhibition, Philadelphia, made by Charles E. Emery, consulting engineer, New York, one of the judges of Group 20.

"The largest and most expensive hydraulic exhibit was the pumping engine for supplying the entire exhibition grounds with water, which was furnished by Mr. Henry R. Worthington, of New York, and was located on the west bank of the Schuylkill, just outside the enclosure, the stand pipe 120 feet high and 208 feet above the river, being within the grounds near the Art Gallery. The engine was of the Worthington duplex type, with a capacity of six million gallons daily. There are two horizontal double-acting pumps with plungers 22¼ inches in diameter arranged side by side on the same frame, each operated directly by a compound engine with steam-jacketed cylinders 29 and 50¼ inches in diameter, the strokes of engines and pumps being four feet. The smaller steam cylinder is attached to the front head of the larger, and has a central piston rod connecting with pump-rod through a cross-head, and two piston rods from larger cylinder pass outside the smaller and connect with the same cross-head. There are two single acting air-pumps, each 29¾ inches in diameter, with 24 inches stroke, which are operated from the ends of a horizontal beam, with vertical lever attached, receiving motion from one main cross-head. The main valves are plain slides operating over double cylinder ports as described hereafter.

The valves for both cylinders of each engine are arranged on the same stem by raising the chest of the smaller, and each valve is provided with a balancing piston. The valves of one engine are operated by bell cranks directly from the reciprocating parts of the other, and no rotative movements, with accompanying details, are required. As previously stated, double cylinder ports are provided. The outer ones receive steam past the ends of the valves and admit same to the cylinder in the usual way. The inner ones communicate with the exhaust cavity of valve only, and enter the cylinder at such distances from the ends that when steam is exhausting through one of same the main piston will run over and close it, and cushion upon the vapor thereby enclosed, the outer part being at the time shut off by the main valve. Valves are provided to put the two cylinder ports at each end in communication to regulate the extent of cushioning. The pump valves consist of rubber disks arranged in chambers above and below the plungers. Each plunger runs without packing in a long grooved ring in a central diaphragm. In operation, one engine, while in full action, moves the valves of the other, when the piston of the latter gradually begins to move and finally attains full velocity as that of the first is checked by the steam cushion, and gradually comes to rest, the pump valves meantime seating quietly.

The piston of first engine pauses a moment till the second engine admits steam, when it commences a return stroke, and the second comes to rest—the action of one blending into that of the other as each alternately takes up the load—the result being that the discharge is uniform, a uniform pressure is maintained in main, and the pumps under any pressure, heavy or light, operate without jar or noise.

The remarkable contrast between engines of this type and the well-known Cornish engines, both in construction and operation, will be appreciated from the above, in connection with the engravings. [We regret that the engravings are not on hand for this issue.] In Cornish and other engines, non-rotative and rotative, in order to practically use steam with considerable expansion, it is necessary to attach to the moving parts heavy masses of metal, which, being accelerated when presures are high, absorb work which is yielded up with a corresponding reduction in velocity as the operating pressures decrease. In the Worthington engines the weight and friction of moving parts are reduced to a minimum, and the elastic force of the steam practically operates upon the water column directly, whereby is secured simplicity of construction and smoothness of working, with a material reduction of frictional resistance; also freedom from the dangers incident to handling the heavy weights in the original form of non-rotative engines. The expansion of steam in the Worthington pumping engine is determined principally by the difference in the sizes of the compound cylinders, and is sufficient, in connection with the freedom from jar, and the low resistance of engines and pumps to secure duties which are quite high when it is considered that the maximum steam pressure so far employed is only 40 pounds.

The official test of one at the Newark Water Works, New Jersey, showed a duty of 77-358,478 pounds of water raised one foot with 100 pounds of coal. The engines show regular average yearly duties as high as sixty millions, in which fuel necessarily expended on account of stoppages is included.*

On the whole, the evidence appears to be that the Worthington Duplex Engines give higher average performances than any other class of pumping engines in use in the United States, except those specially designed to secure economy of steam, and in comparison with these it is proper to consider differences in interest on first cost of engines, and foundations for same, and also in some cases questions as to the ease of management and reliability for extended use under practical conditions.

It is stated that when the load is thrown off from a duplex engine, as has happened by the breakage of a pipe, the steam cushion prevents damage during the first stroke, and afterward the action of the duplex valve gear is to so shorten the strokes that no injury can occur. In the same building with the pumping engine was exhibited a Worthington duplex pump similar to the engine, except that each pump plunger was operated by a single cylinder.

Mr. Worthington exhibited also in the

* In Philadelphia a number of engines of different kinds are employed at the different pumping stations. The following is extracted from the annual reports:

Name of Pumping Engine.	Type of Engine.	Cost of raising One Million Gallons one foot high.				
		1872.	1873.	1874.	1875.	1876.
Belmont	2 Worthington Duplex.	Cents. 7	Cents. 7.68	Cents. 7.68	Cents. 7.84	Cents. 7.07
Roxborough	1 Full Cornish and 1 Worthington Duplex.	9.9	9.92	9.19	10.30	9.51
Delaware	1 High and 1 Low Pressure Rotative & 1 Worthington Duplex, 2 Full Cornish.	13.2	13.14	14.35	12.98	12.69
Schuylkill	1 Double Cylinder Rotative, 1 Belt Crank Rotative.	11.2	17.86	16.97	17.05	13.40
Germantown	Using 1 High Pressure Rotative.	36.2				

rooms of the Ameri-, can Society of Civil Engineers in the west gallery of the main building, models, drawings, and descriptions of considerable historical interest.

Mr. Worthington undoubtedly originated and introduced the first direct acting steam pumps ever constructed (the Cornish and other pumping engines without rotating parts are, of course, excepted), and by his success created a demand for pumps of all kinds. A specimen was shown complete of his first form of pump, as developed in the years 1840–44. In this pump the steam valve is partially reversed by tappets and levers connecting with main piston rod the throw being completed by a spring and arrow-headed bolt. The general features of this plan have been repeated many times since. Mr. Worthington afterward constructed several pumps in which the main valve was operated by an auxiliary piston, as in the more approved modern forms, a portion of one of this kind being exhibited. These pumps are said to have worked well, but were ahead of the times, and in 1849 the Worthington and Baker pump, with relief valve motion, was brought out, which was very favorably received, and created the demand now so well supplied by many manufacturers. To this pump it is believed that the M or double cavity steam slide valve, now universally used in steam pumps, was first applied. It is employed with the ordinary arrangement of cylinder ports on an elevated face, but steam entered under the end of the valve at the end of the cylinder opposite that supplied by an ordinary single cavity valve when moved in the same direction. The pump consisted simply of a steam cylinder and plunger pump, with an arm on the piston rod, extended upward to operate tappets on the valve stem. As the pump neared the end of the stroke openings in pump plunger were uncovered, thereby admitting water from one side of the plunger to the other, and relieving the engine of load, when the stroke was completed by the expansion of the steam in the cylinder with such velocity as to insure the operation of steam valve by means of the tappets. Ericsson is reported to have said of one of these pumps that it represented the greatest efficiency for a given nnmber of parts and quantity or material of any machine he ever had previously seen. The largest pump constructed with this valve gear had a capacity of 300,000 gallons per day, and was erected in 1854 to supply the city of Savannah with water. It was provided with an annular compound steam cylinder, and was running regularly two years since, The sudden reversal of motion at the end of the stroke with this valve gear made its application to larger engines not desirable.

The plan of using a large number of small pump valves was first applied in the year 185[illegible] the system in various forms is hereby [illegible]ed by other manufacturers. As compared with the heavy double beat valves usually employed in pumping engines, the small valves require less lift, produce less jar, and offer less resistance to the passage of the water.

The Worthington duplex engine was perfected about the year 1859, and from 1860 to 1876 no less than eighty have been erected in different parts of the United States and Canada, with capacities varying from one-half million to ten million gallons daily. For engines of moderate size the two pumps are severally operated by cylinders of different sizes, the steam exhausting from one to the other through an intermediate receiver.

Wm. Clark & Co.'s machine shop, Pittsfield, is running full force until 10 o'clock every night.

The Putnam Machine Co. are building a 60 horse power-engine for Bliss & Williams, Newark, N. J. The latter firm have had a 40-horse-power Putnam engine in use for twelve years, and are now enlarging their factory.

The Atlantic Steam Engine Works, Brooklyn, have lately sent sugar mill machinery for five mills to Matanzas, Cuba, and South America.

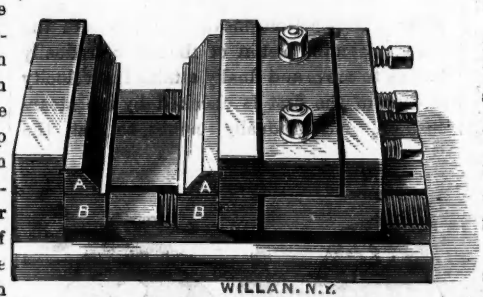
Bliss & Williams, Brooklyn, find a good demand for their presses and machinery for sheet metal in England, also to some extent in France, Sweden, and Germany.

Uses of Injectors.

The *Journal des Fabricants de Sucre* describes various economical applications of the Korting injector, in the removal of gases, liquids and solid. In chimneys that are sufficient for a given number of boilers, the addition of another boiler often weakens the draft, which may be restored by an injector. In one instance two boilers were required, using in 230 hours 78,120 kilogrammes of coal; after adding a Korting injector, only 36,375 kilogrammes were consumed in the same time for the same work, and only one boiler was required. The same injector has also been used as a smoke consumer; as a blower for stoves; as an extractor of carbonic acid gas; as a pump for well water, for thick and muddy liquids, for beet-juice, for milk of lime, for acids, for lyes and for locomotives at watering stations; as an elevator for animal-black, for grain and for granular solids; and as a sugar clarifier.

Indicator for Hot Journals.

One of the French journals, says M. Coret has contrived a simple apparatus for giving an alarm, when boxes are not sufficiently greased. It embraces a certain number of metallic tubes with elastic bottoms, filled with an expansible liquid, the whole enclosed in a small metallic cylinder. The instrument can be attached to a turning arbor, and if the arbor heats, the liquid dilates, forming an electric contact, which sounds an alarm.



WILLAN. N.Y.

"Thomas' Patent Planer Vise.

This is a new style of vise lately put in the market after a trial of over two years in the shop where made.

It supplies a want long felt among machinists generally for an improvement on the old style of planer vises, with which a good deal of valuable time is lost in adjusting the work so that it may be planed square or parallel, it having often to be reset several times before it is satisfactory; with the Thomas Vise this difficulty is entirely obviated, no packing or adjusting being required; the work being simply laid between the gibs A.A., on the base, or on the parallel pieces B.B., as may be most convenient, and then fastened; by tightening the set screws first (one of which is generally sufficient) and then the bolts, which by the peculiar construction of the gibs A.A., draw the work down without any hammering, and hold it; by this arrangement all springing or twisting of the work is avoided, and it is planed straight and parallel. A convenience for measuring the work while it is set is also provided, which will be found of great service.

This vise is also adapted to holding taper work, such as gibs, keys, etc., which it holds with the same certainty and falicity as ordinary work.

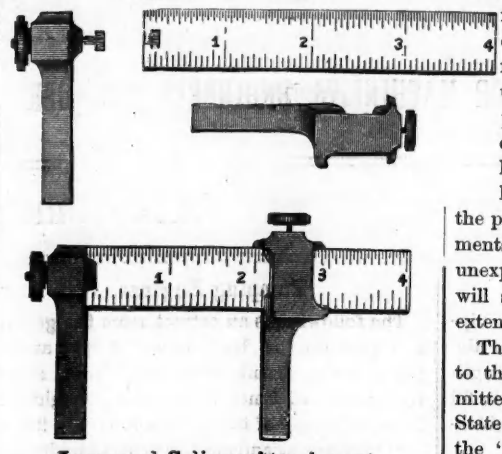
The cut below shows the vise in position for taper work, and also the arrangement of the pawls.

WILLAN. N.Y.

For holding very thin work this vise is excellent, the gibs A.A., having thin edges to grip the work by, permit the whole surface to be planed without removing the tool, and the tendency of the ordinary vises to spring the work is entirely avoided.

In the old style of vises the jaws after a little use get worn out of square, and it is difficult to hold the work properly, but the accuracy of this vise is not affected by this wear on the jaws—in fact, they might be worn 1-16 inch out of square, and they would still hold the work properly; the action of the gibs being such as to hold the work down either on the base or on the parallel pieces; these gibs are the only part of the vise that is subject to much wear, and they may be made of cast iron or steel; a pair of cast iron ones and, also two parallel pieces are furnished with each vise.

They are manufactured by the Freeland Tool Works, New York.



Improved Caliper Attachment.

The above cuts represent newly improved caliper attachments, which, in combination with the ordinary steel scale, make an excellent tool for its general usefulness and accuracy.

This combination may be readily adapted for various measuring purposes. The scale, with both jaws attached, makes a strong, neat and correct caliper gauge; with the sliding jaw removed, a reliable square; with end jaw removed, and sliding jar attached, it may be conveniently used as a depthing gauge; with both jaws detached, we have a perfect Scale or straight edge.

All these changes can be made in a very short time, and unlike most combination tools, this is complete and accurate in every change. The jaws are hardened throughout. In the ordinary caliper square—where the scale and jaws are in one piece—if by constant use the jaw become worn, the divisions are no longer of use for accurate measurement; but in this tool, if the jaws are worn, by a little grinding on a straight surface they may be corrected in a few moments, and replaced as before.

The scales are divided in the most convenient manner, each edge being different. On one side are 16ths and 64ths through the whole length; on the opposite side, 20ths and 100ths in the like manner; and the sliding jaw is so arranged as to read any one of the four divisions—an advantage found in no other tool of its class.

They are made in three sizes,—4, 6, and 12 inch—but any length can be made to order. The larger sizes are especially adapted for planer work, and cost proportionally less than small sizes.

If any part should be injured or lost, it can be replaced at a reasonable cost, as they are made by special tools, and are uniform in size and shape.

This tool is especially designed for workmen employed on contract work or on time, as its price and range of usefulness place it within the reach of people of moderate means. They are furnished with Brown & Sharpe's scales, made specially for the purpose.

They are manufactured by Stone & Hazelton, 13 Bowker street, Boston.

Explosions of Steam Boilers.

BY JOHN W. HILL, M. E., A MEMBER OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The alarming frequency of explosions, especially in the rural districts, demands that the attention of State Legislatures be directed to a speedy solution of the important problem of safety in the use of steam boilers. The interest of the public in a proper system of inspection of steam boilers is rapidly developing, and the necessity for such a surveillance of the manufacture and operation of this eminently useful and dangerous adjunct of civilization, as will reduce explosions to a minimum, is probably felt by all, however remotely interested in steam machinery.

What is required is the appointment of a Board of Inspectors in every State, to investigate and report upon every explosion, as well as to pursue a rigid system of inspection of the construction and use of steam boilers.

Whilst it is not imagined that such a Board could enter upon their duties sufficiently charged with information to prevent all explosions in the future, their association with the work from year to year, and by frequent exchange of views with other similar Boards, would presently expand and develop their knowledge in a manner not to be attained by other processes.

It appears to the writer that the appointment of an engineer with a selected corps of assistants, to inspect all boilers now in use and recommend legal measures for the prevention of disastrous explosions in the future, would be quite as desirable a "luxury" as the usual Geological corps, for whilst the labors of the latter may improve our knowledge of the physical structure of our respective increments of the sphere, and open up avenues to unexpected wealth, the labors of the former will save priceless lives and property to the extent of millions.

That there are certain political objections to the inauguration of such a system is admitted, but the combined wisdom of our State law-makers should be sufficient to meet the "legal" and "moral" impediments to a rigid law regulating the manufacture and use of steam boilers.

However this may be, no one who is a constant reader of the metropolitan daily papers can doubt the necessity of a careful system of inspection of the materials and workmanship employed in the construction of steam boilers, and in the use of the boiler after it is set to work.

The great majority of accidents are not with boilers in the hands of men who, from the force of circumstances, are supposed to have a certain knowledge of the "regimes" to be established in operating a steam boiler, but with the rural steam users whose knowledge is naturally very "limited," and as naturally very "dangerous." Whether the frequency of explosions in the "country" is the immediate result of the lack of appreciation of the dangers surrounding a seething boiler, or to impositions practiced on the unwary by knavish boiler-makers in furnishing poor workmanship and defective materials, is a question to be determined. That poor materials and workmanship are often the "prime" cause of disastrous explosions is well known, and however this may be, a system of rigid inspection, by competent officials in every State, would speedily bring the construction and use of steam boilers to the proper level.

The system of inspection should embrace: The form of boiler as affected by the water of the locality in which it is to be used; the variability of load, and the fuel to be burned in the furnace; the dimensions as affected by maximum capacity required; the thickness of plates, class of riveting and caulking, and quality of iron to be used as affected by maximum pressure under which the boiler is to be worked; the test to be applied to the iron used, and the tests to be applied to the finished boilers; the manner of heating and purifying the feed water and its introduction into the boiler; the style of furnace to be used and general arrangement for facility of inspection; the safety appliances, and standard of tests for "steam gauges," "safety valves," low water alarms, and other devices applied to steam boilers.

Every steam boiler now in use, and every steam boiler made in the future should be subject to inspection, and a "seal" put upon it, and a certificate with restrictions under which it may be worked, furnished the owner, tampering with the one or exceeding the other to be visited with a severe punishment.

In France a manufacturer cannot put in use a steam boiler without a permit from the prefect of the department. In making an application for "license" to purchase and put to work a steam boiler, the manufacturer addresses the prefect on a government blank furnishing the following information: Maximum pressure of steam under which the boiler is to work; horse-power and class of connected engine; form of boiler desired; location of boiler in relation to buildings and public highway; fuel to be burned; nature of business conducted in the establishment, and plan of location (on separate sheet).

The prefect of the department refers the application to the prefect of the *arrondissement*, who in turn refers it to the mayor of the *commune;* this officer then proceeds to an investigation *de commodo et incommodo*. The investigation is continued for ten days; five days after its termination the mayor addresses the *proces-verbal* of the investigation, with his recommendation in the premises, to the prefect of the *arrondissement* who transmits with his opinion to the prefect of the department. The prefect then lays the *proces* before the nearest government engineer who examines and delivers an opinion upon which the decision of the prefect is based. This decree of 1810 (which, as the writer is advised, is still in force) in connection with an ordinance passed in 1843 relating to steam boilers, which provides that the boiler shall be tested—first, at the shop where it is built; second, at the establishment where it is to be used—by the nearest government engineer, who after inspection furnishes the owner a certificate of condition and restrictions under which the boiler shall be operated. The tests are *obligatory* (except for mines) and give the manufacturer an *immunity* in the use of a steam boiler nowhere else approximated.

Under our system, or rather lack of system, the manufacturer buys and operates his boiler at his own option; if he desires to drive a forty horse-power engine with a twenty horse-power boiler, there is no law so far as the writer is aware to prevent his doing so.

The one great impediment to procuring a legal enactment relating to steam boilers is the general indifference of the public to the safety of human life. Take the preceding instance: If in carrying out the intention to drive a forty horse-power engine with the twenty horse-power boiler, the boiler "lets go," the public sympathy would be as great for the man who lost the boiler as for the men who lost their lives.

As an illustration of this, the writer would relate a circumstance happening several years ago:

A steam boiler furnishing power to a very large agricultural machine shop, exploded with terrible violence, demolishing one entire section of the building, and killing and injuring several of the workmen; the writer, coming on the ground a few minutes after the explosion, saw the workmen bearing off the corpse of one of the victims. Shocked at the sight, and desirous of ascertaining the extent of damage to life and limb, he suggested to a bystander "that it appeared to be a very rough accident;" the response came in a suppressed tone, "It was rough on Smith, he would be obliged to buy a new boiler." In this instance six men were killed and perhaps twenty seriously injured. It may not be out of place to remark that this was one of those rare cases where the engineer enjoyed the princely income of "six dollars a week."

In nearly every instance of boiler explosion, it appears that the usual legal investigation of the causes of the accident is a mere "farce," that neither determines the real or proximate causes, or locates the blame where it properly belongs; and whilst the facts usually adduced at the inquest may form a foundation upon which the experienced engineer can build a theory of explosion, it is in the great majority of cases simply absurd to base a legal verdict upon the opinion of men whose knowledge of the steam boiler is of the most limited kind.

Several years ago a small cylinder boiler furnishing steam to a "digester" in a large soap and candle works in Cincinnati, suddenly "let go," killing the attendant and one of the factory hands on the spot; while a section of the shell, weighing upwards of a thousand pounds, passed directly up two or three hundred feet, thence westward nearly a half mile and fell killing three small children.

At the inquest it was ascertained that no one but the attendant was to blame, and as he was already dead, the coroner "generously forebore to prosecute him;" at the same time the facts in this case as related to the writer by the previous attendant of the boiler, were such as to have condemned the proprietors to several years penal servitude, under the "boiler law" of Prussia.

Coupled with the lack of legal inspection, the general location of boilers in many of our large manufacturing establishments is reprehensible in the highest degree. In the city of Cincinnati there is a certain establishment covering a superfice of 300x200 feet, and lifting skywards seven stories.

Each of the floors, except the basement, contains a small army of workmen, and thousands of dollars worth of costly materials and manufactured goods in various stages of completion. In the basement about as central as posts and stone pillars would permit, is located the battery of boilers furnishing the power to drive the machinery. Let us suppose an explosion in this case, what would be the probable results? Is it to be imagined that any large portion of the several hundred workmen shut up in this miniature Vesuvius would escape whole? By no means. Let the slender threads now linking safety to disaster loose their hold, and the pent up volcano would burst forth pouring human lava through the vents. Such an occurrence would fall upon the community like a mantle of darkness, and great would be the desire to locate the blame *somewhere*. The coroner would assume an air of marvelous concern, and swear by the party that put him in office, that the affair should be probed to the quick, and the fault brought home to its father, "though angels weep." To this end a jury would be struck, composed of distinguished citizens, with a plentiful *lack* of information upon the questions to be brought before them, who after the usual delays would "on with the quest."

The picture may be highly colored, but the outlines are lifelike, as any one may verify who will read the testimony and verdicts of the inquests following appalling accidents.

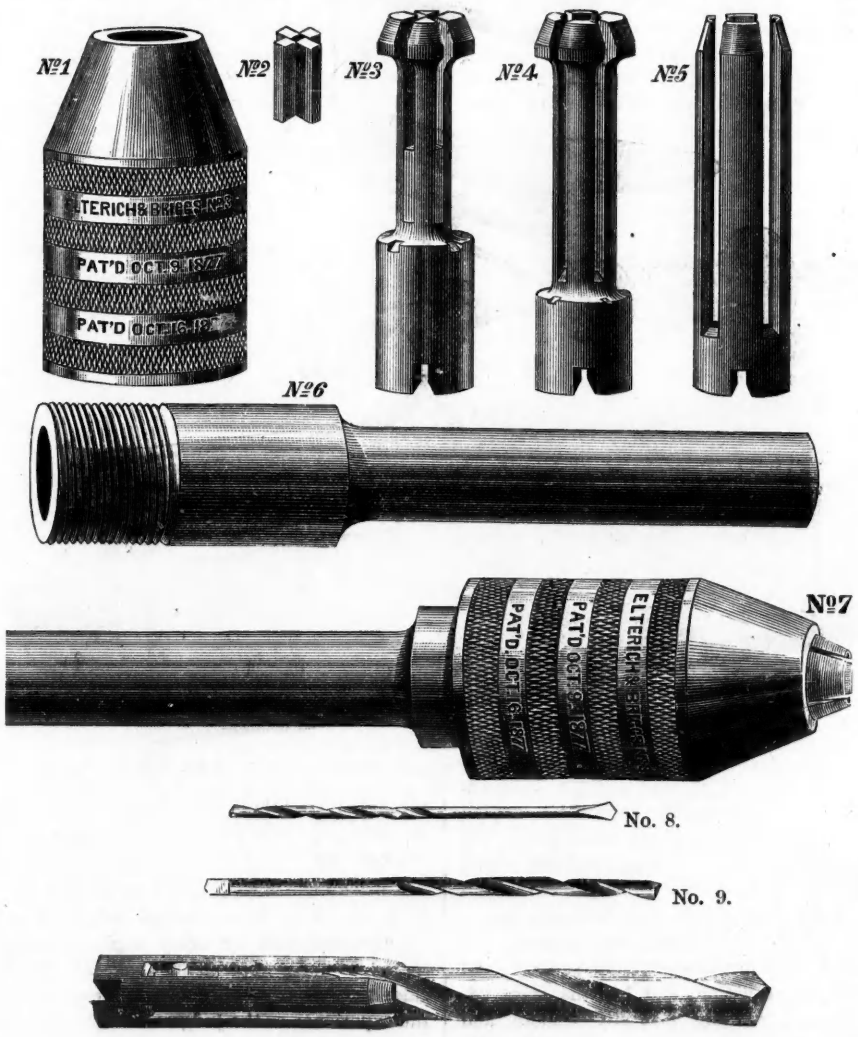
The fall of the Dixon Bridge, the breaking of the Mill River dam, the Ashtabula horror, and the late total demolition of the Rockford Court House, furnish excellent magazines of information upon the customary "legal" proceedings following these wholesale murders.

If we could have the inquest before the accident instead of after, how much better it would be; although this might seem "paradoxical," it is the spirit of the French law regulating the use of steam boilers, and an explosion in that country *is a rare event.—Van Nostrand's Magazine.*

Within two months F. O. Moorehouse & Co., Philadelphia, have placed their Bilgram variable cut-off engines in Chas. McGarge & Co.'s Wissahickon Paper Mills (14 by 30 inches), in McKean, Newhall & Borie's Sugar House (14 by 30 inches), in John Lang's Paper Mill, (15 by 36 inches) in Wm. H. Nixons Paper Mill (15 by 36 inches), and in Brown & Sons Works (20 by 36 inches), all of Philadelphia.

The Elterich Drill Chuck.

The accompanying illustrations show a new style of drill chuck, designed to prevent the drill from slipping or turning while in use, and to withstand a great deal of rough usage. Chuck No. 3, shown herewith, takes drills from ½ inch diameter to the smallest size made. It consists of a mandril (Cut No. 6), hollow at one end, which is threaded on the outer surface, so as to receive the cap (Cut No. 1). Cuts Nos. 3, 4 and 5 represent spring ferrules, which fit the socket of the mandril (Cut No. 6), and are prevented from turning therein by means of a slot in the bottom of them, which fits to a cross pin in the bottom of the socket. The first of these ferrules will hold drills from 5-32 inch to 0; the second, 5-16 inch to 5-32 inch; and the third, ½ inch to 5-16 inch. These ferrules can be interchanged as quickly as drills, and can be replaced without delay at a small cost when necessary, by new ones that do not require to be fitted, as they are all made to a standard size, and are kept in stock. Drills smaller than ⅛ inch are flattened on the ends of the shanks by filing the largest sizes, as in Cut No. 9, and by a blow of the hammer on the smallest sizes, as in Cut No. 8. Drills from ½ inch to ⅛ inch are slotted in the ends, so as to engage with a cross piece dropped into the ferrule. Drills from ⅛ inch to the smallest size are made to engage by means of the flattened ends of the small ones holding them so firmly that they cannot slip in the chuck, while the cap, being screwed down, draws the spring jaws together and brings the point of the drill to a center. As the drills become shortened by wear they can be drawn partially out of the chuck. In such cases a piece of straight wire should be dropped into the ferrule, behind them, to act as a support or rest for them to back against. It will be noticed that drills to use in this chuck have extra long shanks. The mandril of the chuck (see Cut No. 6), can be turned down to fit the socket of any lathe or drill press mandril.



THE ELTERICH DRILL CHUCK.

For those who desire it, this chuck is made with a short shank, which is bored with a taper hole for fitting to lathes that have solid mandrils.

Adjustable spring-jawed chucks have been in existence ever since drills have been in use, but the objection to all former styles has been that they grip the drill only at the point and do not hold it at the back. That objection is overcome in this case by the centering piece, which keeps the drill parallel with the jaws of the chuck. The construction is such as to allow a considerable amount of metal being put into the cap, and the chuck is likely to exhibit great endurance. The three ferrules admit of a wide range of sizes of drills, which is not the case with any other spring chuck that has come under our notice. Spring chucks have heretofore been unsuccessful, owing to defects which it is claimed are overcome in the Elterich chuck. All others of the class allow the ferrule to turn in the chuck, which is fully prevented in this, as before explained. The manufacturers are Frasse & Co., New York.

Rules and Regulations.

Many large machine shops have regular printed rules posted in some conspicuous place for the government of employees. We select the following from a considerable number attracting our attention:

SHOP RULES (No. 1.)

1. "Regular hours of labor from 7 a. m. to 12 m. and from 1 to 6 p. m. Ten full hours a day's work. Full time allowed only to those who are at work promptly at the time of commencement and keep at work until the closing hours. Extra time only paid for by special agreement."

2. "Workmen will bear in mind that they are employed to work to the best of their ability and for the best interest of the company which employs them during the full hours of labor, and this requires them to do cheerfully and promptly any job they may be asked to do; to keep their tools in the best condition, and run any machine on which they may be at work at the speed and feed which shall accomplish the most work, and take pains to do their work promptly and in the best manner."

3. "Those who fail to do this and who through neglect, carelessness or inattention to their work, spoil or injure their work, break, injure, or loose tools, will be held responsible for the damage to the same."

4. "No loud, profane or unnecessary conversation, fooling or annoying other workmen or spending their time loafing about the shop allowed. The first offense in this respect will be a sufficient reason for discharge."

5. "No peddling or loafing during work hours or smoking at any time allowed in the shop."

6. "Workmen will be careful in burning the gas to see that it is not wasted—return all tools promptly to the tool room—close their windows at night and give notice of their wish to be absent."

7. "No one allowed to do any work on his private account without special permission."

The foregoing rules are from a prominent manufactory of wood-working machinery.

Time cards are employed in many machine shops, similar to the one below, which we borrow from a large manufactory of machinists' tools:

TIME CARD.

Work done by Mr.. .....

For.....

No. Hours.	DESCRIPTION OF WORK.

"Tools taken from the tool room will be charged to the person to whom they are delivered, who will be held responsible for their return, *clean*, promptly after use. These tools must not be passed from one to another; all transfers must be made at the tool room."

"As each man cannot be furnished with a set of dogs, they must be put upon the shelves on the center columns promptly after use; in no case may they be put into draws or under the bench."

Sockets belonging to the upright drills are not to be taken from their place for use in any other machine. Extra sockets can be obtained at the tool room; they must be returned promptly after use. In taking the socket from the drill, use a center key; never rap them out, as it springs them."

"It is expected that each person will begin work promptly at 7 and 1 o'clock, work till 12

L 621.051
1
265073
50961

rooms of the Ameri-, can Society of Civil Engineers in the west gallery of the main building, models, drawings, and descriptions of considerable historical interest.

Mr. Worthington undoubtedly originated and introduced the first direct acting steam pumps ever constructed (the Cornish and other pumping engines without rotating parts are, of course, excepted), and by his success created a demand for pumps of all kinds. A specimen was shown complete of his first form of pump, as developed in the years 1840–44. In this pump the steam valve is partially reversed by tappets and levers connecting with main piston rod the throw being completed by a spring and arrow-headed bolt. The general features of this plan have been repeated many times since. Mr. Worthington afterward constructed several pumps in which the main valve was operated by an auxiliary piston, as in the more approved modern forms, a portion of one of this kind being exhibited. These pumps are said to have worked well, but were ahead of the times, and in 1849 the Worthington and Baker pump, with relief valve motion, was brought out, which was very favorably received, and created the demand now so well supplied by many manufacturers. To this pump it is believed that the M or double cavity steam slide valve, now universally used in steam pumps, was first applied. It is employed with the ordinary arrangement of cylinder ports on an elevated face, but steam entered under the end of the valve at the end of the cylinder opposite that supplied by an ordinary single cavity valve when moved in the same direction. The pump consisted simply of a steam cylinder and plunger pump, with an arm on the piston rod, extended upward to operate tappets on the valve stem. As the pump neared the end of the stroke openings in pump plunger were uncovered, thereby admitting water from one side of the plunger to the other, and relieving the engine of load, when the stroke was completed by the expansion of the steam in the cylinder with such velocity as to insure the operation of steam valve by means of the tappets. Ericsson is reported to have said of one of these pumps that it represented the greatest efficiency for a given nnmber of parts and quantity or material of any machine he ever had previously seen. The largest pump constructed with this valve gear had a capacity of 300,000 gallons per day, and was erected in 1854 to supply the city of Savannah with water. It was provided with an annular compound steam cylinder, and was running regularly two years since. The sudden reversal of motion at the end of the stroke with this valve gear made its application to larger engines not desirable.

The plan of using a large number of small pump valves was first applied in the year 185[illegible] the system in various forms is hereby [illegible]ed by other manufacturers. As compared with the heavy double beat valves usually employed in pumping engines, the small valves require less lift, produce less jar, and offer less resistance to the passage of the water.

The Worthington duplex engine was perfected about the year 1859, and from 1860 to 1876 no less than eighty have been erected in different parts of the United States and Canada, with capacities varying from one-half million to ten million gallons daily. For engines of moderate size the two pumps are severally operated by cylinders of different sizes, the steam exhausting from one to the other through an intermediate receiver.

Wm. Clark & Co.'s machine shop, Pittsfield, is running full force until 10 o'clock every night.

The Putnam Machine Co. are building a 60 horse power-engine for Bliss & Williams, Newark, N. J. The latter firm have had a 40-horse-power Putnam engine in use for twelve years, and are now enlarging their factory.

The Atlantic Steam Engine Works, Brooklyn, have lately sent sugar mill machinery for three mills to Matanzas, Cuba, and South America.

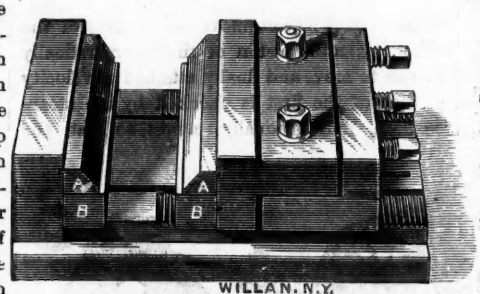
Bliss & Williams, Brooklyn, find a good demand for their presses and machinery for sheet metal in England, also to some extent in France, Sweden, and Germany.

Uses of Injectors.

The *Journal des Fabricants de Sucre* describes various economical applications of the Korting injector, in the removal of gases, liquids and solid. In chimneys that are sufficient for a given number of boilers, the addition of another boiler often weakens the draft, which may be restored by an injector. In one instance two boilers were required, using in 230 hours 78,120 kilogrammes of coal; after adding a Korting injector, only 36,375 kilogrammes were consumed in the same time for the same work, and only one boiler was required. The same injector has also been used as a smoke consumer; as a blower for stoves; as an extractor of carbonic acid gas; as a pump for well water, for thick and muddy liquids, for beet-juice, for milk of lime, for acids, for lyes and for locomotives at watering stations; as an elevator for animal-black, for grain and for granular solids; and as a sugar clarifier.

Indicator for Hot Journals.

One of the French journals, says M. Coret has contrived a simple apparatus for giving an alarm, when boxes are not sufficiently greased. It embraces a certain number of metallic tubes with elastic bottoms, filled with an expansible liquid, the whole enclosed in a small metallic cylinder. The instrument can be attached to a turning arbor, and if the arbor heats, the liquid dilates, forming an electric contact, which sounds an alarm.



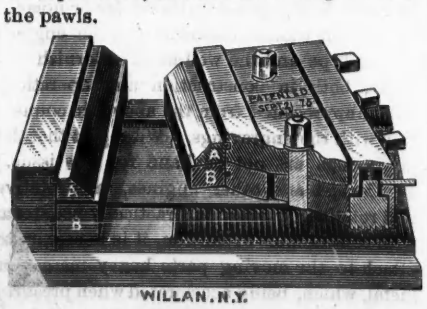
"Thomas' Patent Planer Vise.

This is a new style of vise lately put in the market after a trial of over two years in the shop where made.

It supplies a want long felt among machinists generally for an improvement on the old style of planer vises, with which a good deal of valuable time is lost in adjusting the work so that it may be planed square or parallel, it having often to be reset several times before it is satisfactory; with the Thomas Vise this difficulty is entirely obviated, no packing or adjusting being required; the work being simply laid between the gibs A.A., on the base, or on the parallel pieces B.B., as may be most convenient, and then fastened; by tightening the set screws first (one of which is generally sufficient) and then the bolts, which by the peculiar construction of the gibs A.A., draw the work down without any hammering, and hold it; by this arrangement all springing or twisting of the work is avoided, and it is planed straight and parallel. A convenience for measuring the work while it is set is also provided, which will be found of great service.

This vise is also adapted to holding taper work, such as gibs, keys, etc., which it holds with the same certainty and falicity as ordinary work.

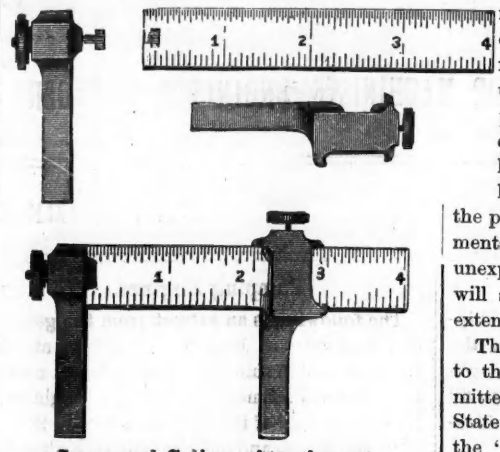
The cut below shows the vise in position for taper work, and also the arrangement of the pawls.



For holding very thin work this vise is excellent, the gibs A.A., having thin edges to grip the work by, permit the whole surface to be planed without removing the tool, and the tendency of the ordinary vises to spring the work is entirely avoided.

In the old style of vises the jaws after a little use get worn out of square, and it is difficult to hold the work properly, but the accuracy of this vise is not affected by this wear on the jaws—in fact, they might be worn 1-16 inch out of square, and they would still hold the work properly; the action of the gibs being such as to hold the work down either on the base or on the parallel pieces; these gibs are the only part of the vise that is subject to much wear, and they may be made of cast iron or steel; a pair of cast iron ones and, also two parallel pieces are furnished with each vise.

They are manufactured by the Freeland Tool Works, New York.



Improved Caliper Attachment.

The above cuts represent newly improved caliper attachments, which, in combination with the ordinary steel scale, make an excellent tool for its general usefulness and accuracy.

This combination may be readily adapted for various measuring purposes. The scale, with both jaws attached, makes a strong, neat and correct caliper gauge; with the sliding jaw removed, a reliable square; with end jaw removed, and sliding jar attached, it may be conveniently used as a depthing gauge; with both jaws detached, we have a perfect Scale or straight edge.

All these changes can be made in a very short time, and unlike most combination tools, this is complete and accurate in every change. The jaws are hardened throughout. In the ordinary caliper square—where the scale and jaws are in one piece—if by constant use the jaw become worn, the divisions are no longer of use for accurate measurement; but in this tool, if the jaws are worn, by a little grinding on a straight surface they may be corrected in a few moments, and replaced as before.

The scales are divided in the most convenient manner, each edge being different. On one side are 16ths and 64ths through the whole length; on the opposite side, 20ths and 100ths in the like manner; and the sliding jaw is so arranged as to read any one of the four divisions—an advantage found in no other tool of its class.

They are made in three sizes,—4, 6, and 12 inch—but any length can be made to order. The larger sizes are especially adapted for planer work, and cost proportionally less than small sizes.

If any part should be injured or lost, it can be replaced at a reasonable cost, as they are made by special tools, and are uniform in size and shape.

This tool is especially designed for workmen employed on contract work or on time, as its price and range of usefulness place it within the reach of people of moderate means. They are furnished with Brown & Sharpe's scales, made specially for the purpose.

They are manufactured by Stone & Hazelton, 13 Bowker street, Boston.

Explosions of Steam Boilers.

BY JOHN W. HILL, M. E., A MEMBER OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The alarming frequency of explosions, especially in the rural districts, demands that the attention of State Legislatures be directed to a speedy solution of the important problem of safety in the use of steam boilers. The interest of the public in a proper system of inspection of steam boilers is rapidly developing, and the necessity for such a surveillance of the manufacture and operation of this eminently useful and dangerous adjunct of civilization, as will reduce explosions to a minimum, is probably felt by all, however remotely interested in steam machinery.

What is required is the appointment of a Board of Inspectors in every State, to investigate and report upon every explosion, as well as to pursue a rigid system of inspection of the construction and use of steam boilers.

Whilst it is not imagined that such a Board could enter upon their duties sufficiently charged with information to prevent all explosions in the future, their association with the work from year to year, and by frequent exchange of views with other similar Boards, would presently expand and develop their knowledge in a manner not to be attained by other processes.

It appears to the writer that the appointment of an engineer with a selected corps of assistants, to inspect all boilers now in use and recommend legal measures for the prevention of disastrous explosions in the future, would be quite as desirable a "luxury" as the usual Geological corps, for whilst the labors of the latter may improve our knowledge of the physical structure of our respective increments of the sphere, and open up avenues to unexpected wealth, the labors of the former will save priceless lives and property to the extent of millions.

That there are certain political objections to the inauguration of such a system is admitted, but the combined wisdom of our State law-makers should be sufficient to meet the "legal" and "moral" impediments to a rigid law regulating the manufacture and use of steam boilers.

However this may be, no one who is a constant reader of the metropolitan daily papers can doubt the necessity of a careful system of inspection of the materials and workmanship employed in the construction of steam boilers, and in the use of the boiler after it is set to work.

The great majority of accidents are not with boilers in the hands of men who, from the force of circumstances, are supposed to have a certain knowledge of the "regimes" to be established in operating a steam boiler, but with the rural steam users whose knowledge is naturally very "limited," and as naturally very "dangerous." Whether the frequency of explosions in the "country" is the immediate result of the lack of appreciation of the dangers surrounding a seething boiler, or to impositions practiced on the unwary by knavish boiler-makers in furnishing poor workmanship and defective materials, is a question to be determined. That poor materials and workmanship are often the "prime" cause of disastrous explosions is well known, and however this may be, a system of rigid inspection, by competent officials in every State, would speedily bring the construction and use of steam boilers to the proper level.

The system of inspection should embrace: The form of boiler as affected by the water of the locality in which it is to be used; the variability of load, and the fuel to be burned in the furnace; the dimensions as affected by maximum capacity required; the thickness of plates, class of riveting and caulking, and quality of iron to be used as affected by maximum pressure under which the boiler is to be worked; the test to be applied to the iron used, and the tests to be applied to the finished boilers; the manner of heating and purifying the feed water and its introduction into the boiler; the style of furnace to be used and general arrangement for facility of inspection; the safety appliances, and standard of tests for "steam gauges," "safety valves," low water alarms, and other devices applied to steam boilers.

Every steam boiler now in use, and every steam boiler made in the future should be subject to inspection, and a "seal" put upon it, and a certificate with restrictions under which it may be worked, furnished the owner, tampering with the one or exceeding the other to be visited with a severe punishment.

In France a manufacturer cannot put in use a steam boiler without a permit from the prefect of the department. In making an application for "license" to purchase and put to work a steam boiler, the manufacturer addresses the prefect on a government blank furnishing the following information: Maximum pressure of steam under which the boiler is to work; horse-power and class of connected engine; form of boiler desired; location of boiler in relation to buildings and public highway; fuel to be burned; nature of business conducted in the establishment, and plan of location (on separate sheet).

The prefect of the department refers the application to the prefect of the *arrondissement*, who in turn refers it to the mayor of the *commune;* this officer then proceeds to an investigation *de commodo et incommodo*. The investigation is continued for ten days; five days after its termination the mayor addresses the *proces-verbal* of the investigation, with his recommendation in the premises, to the prefect of the *arrondissement* who transmits with his opinion to the prefect of the department. The prefect then lays the *proces* before the nearest government engineer who examines and delivers an opinion upon which the decision of the prefect is based. This decree of 1810 (which, as the writer is advised, is still in force) in connection with an ordinance passed in 1843 relating to steam boilers, which provides that the boiler shall be tested—first, at the shop where it is built; second, at the establishment where it is to be used—by the nearest government engineer, who after inspection furnishes the owner a certificate of condition and restrictions under which the boiler shall be operated. The tests are *obligatory* (except for mines) and give the manufacturer an *immunity* in the use of a steam boiler nowhere else approximated.

Under our system, or rather lack of system, the manufacturer buys and operates his boiler at his own option; if he desires to drive a forty horse-power engine with a twenty horse-power boiler, there is no law so far as the writer is aware to prevent his doing so.

The one great impediment to procuring a legal enactment relating to steam boilers is the general indifference of the public to the safety of human life. Take the preceding instance: If in carrying out the intention to drive a forty horse-power engine with the twenty horse-power boiler, the boiler "lets go," the public sympathy would be as great for the man who lost the boiler as for the men who lost their lives.

As an illustration of this, the writer would relate a circumstance happening several years ago:

A steam boiler furnishing power to a very large agricultural machine shop, exploded with terrible violence, demolishing one entire section of the building, and killing and injuring several of the workmen; the writer, coming on the ground a few minutes after the explosion, saw the workmen bearing off the corpse of one of the victims. Shocked at the sight, and desirous of ascertaining the extent of damage to life and limb, he suggested to a bystander "that it appeared to be a very rough accident;" the response came in a suppressed tone, "It was rough on Smith, he would be obliged to buy a new boiler." In this instance six men were killed and perhaps twenty seriously injured. It may not be out of place to remark that this was one of those rare cases where the engineer enjoyed the princely income of "six dollars a week."

In nearly every instance of boiler explosion, it appears that the usual legal investigation of the causes of the accident is a mere "farce," that neither determines the real or proximate causes, or locates the blame where it properly belongs; and whilst the facts usually adduced at the inquest may form a foundation upon which the experienced engineer can build a theory of explosion, it is in the great majority of cases simply absurd to base a legal verdict upon the opinion of men whose knowledge of the steam boiler is of the most limited kind.

Several years ago a small cylinder boiler furnishing steam to a "digester" in a large soap and candle works in Cincinnati, suddenly "let go," killing the attendant and one of the factory hands on the spot; while a section of the shell, weighing upwards of a thousand pounds, passed directly up two or three hundred feet, thence westward nearly a half mile and fell killing three small children.

At the inquest it was ascertained that no one but the attendant was to blame, and as he was already dead, the coroner "generously forebore to prosecute him;" at the same time the facts in this case as related to the writer by the previous attendant of the boiler, were such as to have condemned the proprietors to several years penal servitude, under the "boiler law" of Prussia.

Coupled with the lack of legal inspection, the general location of boilers in many of our large manufacturing establishments is reprehensible in the highest degree. In the city of Cincinnati there is a certain establishment covering a superfice of 300x200 feet, and lifting skywards seven stories.

Each of the floors, except the basement, contains a small army of workmen, and thousands of dollars worth of costly materials nd manufactured goods in various stages of completion. In the basement about as central as posts and stone pillars would permit, is located the battery of boilers furnishing the power to drive the machinery. Let us suppose an explosion in this case, what would be the probable results? Is it to be imagined that any large portion of the several hundred workmen shut up in this miniature Vesuvius would escape whole? By no means. Let the slender threads now linking safety to disaster loose their hold, and the pent up volcano would burst forth pouring human lava through the vents. Such an occurrence would fall upon the community like a mantle of darkness, and great would be the desire to locate the blame *somewhere*. The coroner would assume an air of marvelous concern, and swear by the party that put him in office, that the affair should be probed to the quick, and the fault brought home to its father, "though angels weep." To this end a jury would be struck, composed of distinguished citizens, with a plentiful *lack* of information upon the questions to be brought before them, who after the usual delays would "on with the quest."

The picture may be highly colored, but the outlines are lifelike, as any one may verify who will read the testimony and verdicts of the inquests following appalling accidents.

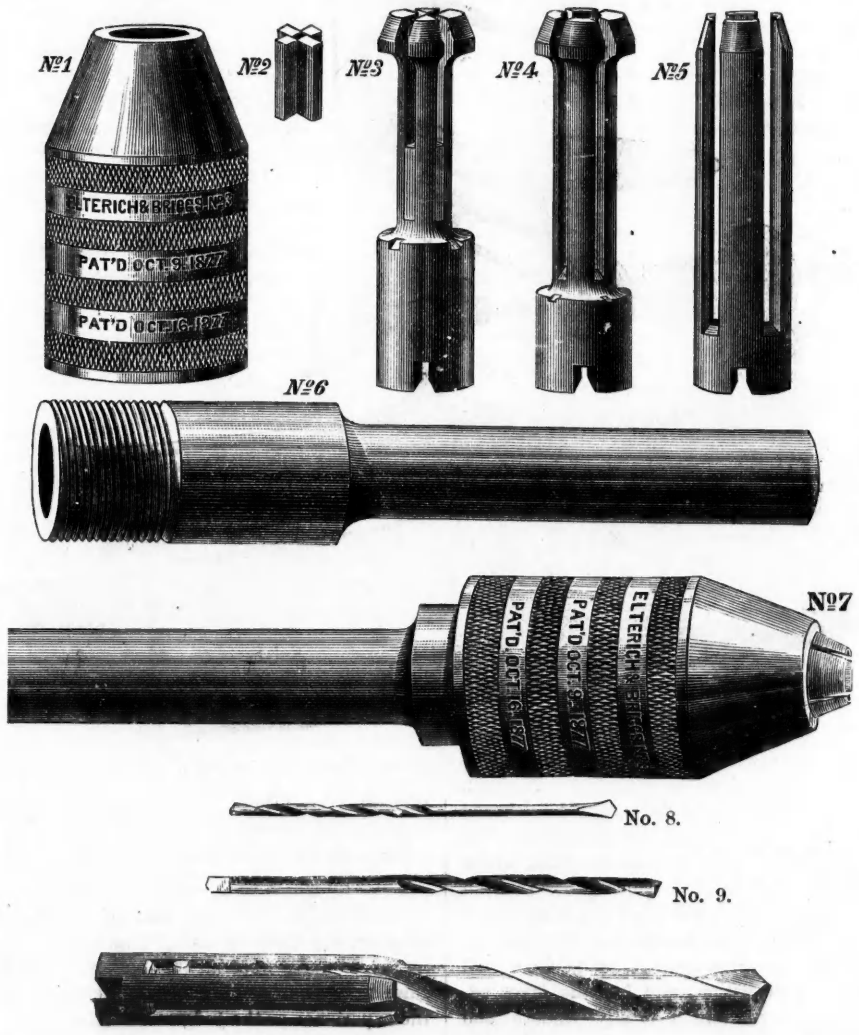
The fall of the Dixon Bridge, the breaking of the Mill River dam, the Ashtabula horror, and the late total demolition of the Rockford Court House, furnish excellent magazines of information upon the customary "legal" proceedings following these wholesale murders.

If we could have the inquest before the accident instead of after, how much better it would be; although this might seem "paradoxical," it is the spirit of the French law regulating the use of steam boilers, and an explosion in that country *is a rare event.—Van Nostrand's Magazine.*

Within two months R. O. Moorehouse & Co., Philadelphia, have placed their Bilgram variable cut-off engines in Chas. McGarge & Co.'s Wissahickon Paper Mills (14 by 30 inches), in McKean, Newhall & Borie's Sugar House (14 by 30 inches), in John Lang's Paper Mill, (15 by 36 inches) in Wm. H. Nixons Paper Mill (15 by 36 inches), and in Brown & Sons Works (20 by 36 inches), all of Philadelphia.

The Elterich Drill Chuck.

The accompanying illustrations show a new style of drill chuck, designed to prevent the drill from slipping or turning while in use, and to withstand a great deal of rough usage. Chuck No. 3, shown herewith, takes drills from ¼ inch diameter to the smallest size made. It consists of a mandril (Cut No. 6), hollow at one end, which is threaded on the outer surface, so as to receive the cap (Cut No. 1). Cuts Nos. 3, 4 and 5 represent spring ferrules, which fit the socket of the mandril (Cut No. 6), and are prevented from turning therein by means of a slot in the bottom of them, which fits to a cross pin in the bottom of the socket. The first of these ferrules will hold drills from 5-32 inch to 0; the second, 5-16 inch to 5-32 inch; and the third, ½ inch to 5-16 inch. These ferrules can be interchanged as quickly as drills, and can be replaced without delay at a small cost when necessary, by new ones that do not require to be fitted, as they are all made to a standard size, and are kept in stock. Drills smaller than ⅛ inch are flattened on the ends of the shanks by filing the largest sizes, as in Cut No. 9, and by a blow of the hammer on the smallest sizes, as in Cut No. 8. Drills from ⅛ inch to ¼ inch are slotted in the ends, so as to engage with a cross piece dropped into the ferrule. Drills from ¼ inch to the smallest size are made to engage by means of the flattened ends of the small ones holding them so firmly that they cannot slip in the chuck, while the cap, being screwed down,



THE ELTERICH DRILL CHUCK.

draws the spring jaws together and brings the point of the drill to a center. As the drills become shortened by wear they can be drawn partially out of the chuck. In such cases a piece of straight wire should be dropped into the ferrule, behind them, to act as a support or rest for them to back against. It will be noticed that drills to use in this chuck have extra long shanks. The mandril of the chuck (see Cut No. 6), can be turned down to fit the socket of any lathe or drill press mandril.

For those who desire it, this chuck is made with a short shank, which is bored with a taper hole for fitting to lathes that have solid mandrils.

Adjustable spring-jawed chucks have been in existence ever since drills have been in use, but the objection to all former styles has been that they grip the drill only at the point and do not hold it at the back. That objection is overcome in this case by the centering piece, which keeps the drill parallel with the jaws of the chuck. The construction is such as to allow a considerable amount of metal being put into the cap, and the chuck is likely to exhibit great endurance. The three ferrules admit of a wide range of sizes of drills, which is not the case with any other spring chuck that has come under our notice. Spring chucks have heretofore been unsuccessful, owing to defects which it is claimed are overcome in the Elterich chuck. All others of the class allow the ferrule to turn in the chuck, which is fully prevented in this, as before explained. The manufacturers are Frasse & Co., New York.

Rules and Regulations.

Many large machine shops have regular printed rules posted in some conspicuous place for the government of employees. We select the following from a considerable number attracting our attention:

SHOP RULES (No. 1.)

1. "Regular hours of labor from 7 a. m. to 12 m. and from 1 to 6 p. m. Ten full hours a day's work. Full time allowed only to those who are at work promptly at the time of commencement and keep at work until the closing hours. Extra time only paid for by special agreement."

2. "Workmen will bear in mind that they are employed to work to the best of their ability and for the best interest of the company which employs them during the full hours of labor, and this requires them to do cheerfully and promptly any job they may be asked to do; to keep their tools in the best condition, and run any machine on which they may be at work at the speed and feed which shall accomplish the most work, and take pains to do their work promptly and in the best manner."

3. "Those who fail to do this and who through neglect, carelessness or inattention to their work, spoil or injure their work, break, injure, or loose tools, will be held responsible for the damage to the same."

4. "No loud, profane or unnecessary conversation, fooling or annoying other workmen or spending their time loafing about the shop allowed. The first offense in this respect will be a sufficient reason for discharge."

5. "No peddling or loafing during work hours or smoking at any time allowed in the shop."

6. "Workmen will be careful in burning the gas to see that it is not wasted—return all tools promptly to the tool room—close their windows at night and give notice of their wish to be absent."

7. "No one allowed to do any work on his private account without special permission."

The foregoing rules are from a prominent manufactory of wood-working machinery.

Time cards are employed in many machine shops, similar to the one below, which we borrow from a large manufactory of machinists' tools:

TIME CARD.

Work done by Mr.. .....

For.....

No. Hours.	DESCRIPTION OF WORK.

"Tools taken from the tool room will be charged to the person to whom they are delivered, who will be held responsible for their return, *clean*, promptly after use. These tools must not be passed from one to another; all transfers must be made at the tool room."

"As each man cannot be furnished with a set of dogs, they must be put upon the shelves on the center columns promptly after use; in no case may they be put into draws or under the bench."

Sockets belonging to the upright drills are not to be taken from their place for use in any other machine. Extra sockets can be obtained at the tool room; they must be returned promptly after use. In taking the socket from the drill, use a center key; never rap them out, as it springs them."

"It is expected that each person will begin work promptly at 7 and 1 o'clock, work till 12

L 621.051
1
265073
50961

and 6 o'clock, and not begin to wash till the whistle blows; also that each person will write upon his card the time and no more time than he has worked."

"Washing hands with oil will not be allowed."

"Each machine must be cleaned after a job is finished by the person who has used it."

"Throwing things in the shop, at any time, is strictly forbidden. The person disregarding this rule will be discharged."

The next set of rules is in force at a manufactory of tools and small parts of machines, fire-arms, &c.

SHOP RULES (No. 2.)

"It is expected that each person employed by this company, whether contractor, or working by the piece, by the day, or otherwise, will begin work promptly at 7 o'clock a. m. and 1 o'clock p. m., work until the whistle blows, and not quit work to wash up before. If any workman is obliged to leave the factory temporarily, during working hours, it is expected he will report to the time-keeper the time he is absent."

"On first entering the factory for the day, each workman will procure of the time-keeper a time-ticket, on which will be marked his name and the date and time of entrance, which must be returned to the time-keeper *the same day*, marked with the time of quitting work."

"Each time-ticket must show the number of hours worked, and whether for company or contractor, and if piece work, the number of hours worked, the name of the article worked on, and the number of pieces turned out, and whether for company or contractor."

"Tools taken from the tool room will be charged to the contractor or workman to whom they are delivered, who will be held responsible for their return, *clean*, promptly after using. These tools must not be passed from one to another; all transfers must be made at the tool room."

"All lathe dogs, carriers, chucks, fixtures and general tools must be returned to their places on the tool rack, *clean*, after using; sockets belonging to the upright drills and hand lathes are not to be taken from their places for use in any other machine. In taking the socket from the drill or lathe, use a center key: never rap them out, as it springs them."

"Each machine must be thoroughly cleaned by the person using it, after the job is done."

"No jobbing will be allowed in the shop except for the company. Throwing things in the shop, at any time, is strictly forbidden. Those who disregard this rule will be discharged. All loud talking, whistling, or gossiping with each other must be avoided in working hours."

The next brief set of rules is pasted up in a manufactory of steam pumps:

SHOP RULES (No. 3.)

"The regular hours of business in these works will be from 7 to 12 a. m. and from 1 to 6 p. m. (winter months excepted)."

"All men employed by the hour, time and a half will be allowed from 6 to 12 p. m. and double time from 12 to 7 a. m."

"Men not present promptly when the whistle sounds for work will be reported thirty minutes late."

"Any one leaving the shop during working hours and going into the saloon will be discharged."

The last rule is hardly necessary for machine shops under ordinary circumstances, but the shop in question is located next door to a flourishing "gin mill" which seems to have had too many allurements for the workmen.

The Stiles & Parker Press Co., Middletown, are making presses for drawing out sheet metal work with remarkable speed and precision. We noticed in their office a brass cap for a "nutmeg" clock, $2\frac{3}{8}$ inches deep, 3 inches on the bottom, and 4 inches on the top, with irregular shaped sides, which was drawn from a flat sheet in two operations without annealing on their new press. Some work of this kind is done on their press with a single operation without annealing. It has heretofore required three operations besides annealing to accomplish the same result.

The Hartford Pump Co. has orders to fill from parties in Buenos Ayres and India.

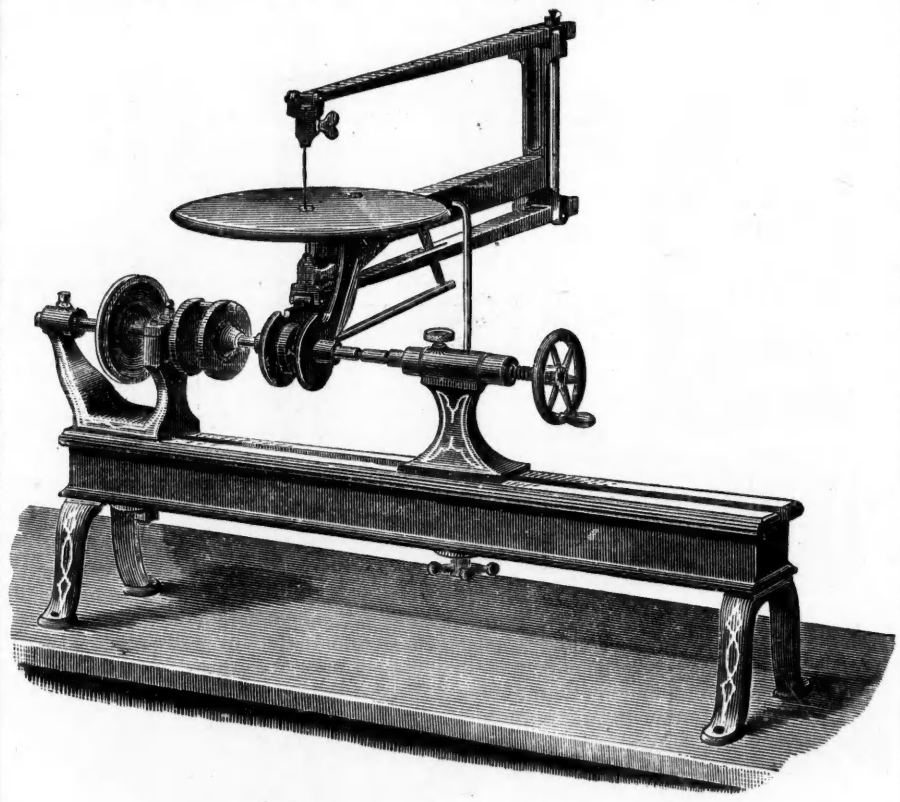
The Speedwell Scroll Saw Attachment for Lathes.

The rapidly increasing taste for mechanical pursuits which is being developed among the younger portion of our population, is causing many of our inventors to turn their attention to devising tools combining cheapness, compactness, and adaptability to the various purposes for which they are intended. The lathe being the fundamental tool of all tools, is naturally the greatest favorite, and it is not surprising there should be such a variety of them. Next in favor comes the scroll saw, and so numerous are the varieties of this machine that to choose the best among them requires no small amount of very good mechanical judgment.

Several attempts have been made to combine the lathe and scroll saw so that the young mechanic having the one may also enjoy the advantages of the other; but as the scroll saw attachment has always been dependant upon the particular lathe for which it was made, and as there are a great number of persons owning lathes to which they cannot apply such attachment, the necessity for one universally applicable is apparent.

The illustration represents such a device, it being so made that the lathe centers (with the additional prop shown in the back part of cut), form the entire support for the machine; in this position the saw is ready to operate when the lathe is set in motion.

The shaft situated on the lathe centers has at one end a driving plate, into which is fitted a pin that connects with the face plate. On the middle of the shaft is an eccentric, which operates an elbow lever which passes through the lower vibrating arm, and connects with it at the front end, immediately beneath the table. This arrangement is positive and simple in its action, and has the great advantage of running perfectly smooth and quiet. The vibrating arms are sufficiently long to allow a swing of sixteen (16) inches. It will be seen that only a few seconds are occupied in removing or placing the machine in position; the means for holding the saw are good, and it is so constructed that the finest as well as the coarsest saws may be used. The table is made of cast-iron, and all the wearing parts are of cast-iron and steel. The cost is such as to bring it within reach of those of limited means.



THE SPEEDWELL SCROLL SAW ATTACHMENT FOR LATHES.

T. R. Almond, 84 Pearl street, Brooklyn, is the inventor and manufacturer.

We lately noticed in the Pratt & Whitney Co.'s shops, Hartford, a die cutting a thread on a $1\frac{1}{2}$ inch bar of round tool steel at the uniform rate of 8 feet per hour. The thread was very true and smooth. The same dies are sent out in their bolt cutting machines.

Lowe & Watson, Bridgeport, are building one of their patent steam boilers, 75 horse-power, for Bliss & Drake's Sad-iron factory, Newark, N. J.

Sizes of Safety Valves.

BY PROF. R. H. THURSTON, OF THE STEVENS INSTITUTE OF TECHNOLOGY.

The office of a safety valve, as used on a steam boiler, is to discharge steam so rapidly, when the pressure within the boiler reaches a fixed limit, that no important increase of pressure can then occur, however rapidly steam may be made. It has also another office: it should be so constructed and arranged that, should any accident occur, it may be opened by hand and the steam pressure lowered very rapidly, even when the fires in the boiler are burning brightly and generating steam with maximum rapidity. The size of a safety valve is determined by the character of the valve itself, by the pressure at which the steam is to be discharged, by the difference permissible between the pressure at which the valve is to open automatically, and that at which it is intended to be capable of discharging steam as fast as the boiler can make it.

A valve of defective design or badly constructed must necessarily be larger, to do the same work, than one of similar type badly designed and constructed. Steam is discharged at any given rate through an orifice of smaller dimensions as the pressure increases; the lower the pressure, on the other hand, the larger must be the valve. A boiler in which steam is carried at 20 pounds by gauge may require a safety valve of 30 inches area, while the same quantity of steam would escape through a rivet hole in a boiler containing steam at pressures such as were attained by Perkins and Albans a generation ago.

Rules by which to calculate the proper area of safety valves for every case arising in his practice, are used by every engineer accustomed to designing steam boilers. These rules vary considerably with differences in the experience or the judgment of their authors. The builders is often inclined to adopt valves of too small size because of the expense of putting on large valves. The engineer, who has once nearly met with a serious accident, to obtain ample security against a repetition of the experience, at once adopts valves of excessive areas; and the designing engineer sometimes bases his rule on improper assumptions or is ignorant of the true conditions, or of the proper method of stating them in the form of a rule. Attention has been lately called to these discrepancies, between the rules given by various so-called authorities, by a writer in a well-known periodical; but the writer, unfortunately, concludes by commending the rule of Prof. Rankine, which, for general applications, is about the most defective of all. It is correct for certain pressures and under the conditions which existed in the experiments and observations on which it is based. Containing no reference to the pressure of steam, however, it simply misleads when generally applied. The conclusion is, not that Rankine was careless in framing the rule, but that the engineer, in applying it, must understand under what circumstances it is applicable. The same remarks apply in some degree to the rules attributed to the writer. The discrepancies noted in the report of the committee would have been less marked had the rules been properly used.

A rule for general application must always give an area determined by the quantity of steam to be discharged and the pressure at which it is to be discharged. A perfectly exact rule would involve the determination of other quantities, as the specific volume of the steam, the proportion of water carried by it in suspension, the difference between internal and external pressure, for the purposes of the engineers. These quantities may be neglected, or may be taken into account by a simple modification of the formula used, as will be presently shown.

Rules are very commonly used which are based upon the amount of coal burned per hour in the given case. Such rules involve the assumption that each pound of coal evaporates a definite and known quantity of water. Another class of rules make the area of the valve depend upon the dimensions of the boiler, as on the area of heating or of grate surface. These rules involve an assumption that the area of heating or of grate surface is proportional to the quantity of steam made in the boiler in a given time. It is evident that, with a given boiler, the conditions upon which rules of the first class are based are variable, while those of the second are constant. Rules based upon the weight of steam made, or of coal burned, in the boiler must therefore be determined by the *maximum* consumption of coal or production of steam for which the boiler is proportioned. Rules based upon the size of the boiler or area of its grate surface must be so constructed that the area given by them will be ample for the discharge of more steam than the boiler can make by evaporation from the given amount of heating surface, or by the combustion of all the coal that can be burned upon the grate under the conditions of draught which are to be anticipated. Properly constructed and properly used, it is a matter of perfect indifference which kind of rule is adopted. The two classes of rule will give the same results if both are intelligently framed and applied.

The weight of steam in pounds which will escape through an orifice in the boiler having an area of one square inch is, in ordinary practice, very nearly fifty times the pressure of the steam measured from the absolute zero of pressure, *i. e.*, above a vacuum. The area of opening, therefore, for any boiler must be, in square inches, the weight of water evaporated per hour as a maximum, divided by fifty times the guage pressure with fifteen pounds added; *i. e.*

$$A. = \frac{w.}{50, (p. + 15),}$$

or,

$$a = 0.02\,[w + (p + 15)].$$

But a safety valve, as has been stated, should be capable of discharging very much more than the maximum quantity of steam that the boiler can make when doing its best. The valve must be raised, ordinarily, by the action of the steam itself, and the force exerted by the steam pressure upon its disk rapidly diminishes as it rises from its seat. The seat is beveled, too, in such a manner that the effective area for discharge of steam is but a fraction of that due the rise of a valve having an unbeveled seat. It is therefore advisable to give a large excess of area over that above determined. How great this excess shall be is very generally determined by the judgment of the engineer, as formed by observation and experience and checked by direct experiment. Very few engineers, probably, err seriously on the side of excess.

In making up a set of rules for safety valve areas some years ago, the writer adopted the rule: multiply the maximum weight of steam which the boiler is expected to generate per hour by five and divide by ten times the guage pressure increased by ten; or, divide that weight by twice the latter quantity.

$$a = \frac{0.5\ w,}{p + 10.}$$

The gauge pressure is increased by ten rather than by fifteen in order to secure some additional excess at the lower pressures, a proportionally smaller difference between

opening and maximum pressures being there admissible.

From this rule it is easy to deduce special rules for any other desired application; as to boilers of which the dimensions are given. Thus, the writer had occasion to design safety valves for steam boilers having a ratio of grate to heating surface of about one to twenty-five. These boilers had a "natural draught" and were expected to burn, as a maximum about fifteen pounds of coal per square foot of grate. Such boilers will make, as a maximum, about 5 pounds of steam per hour per square foot of heating surface. A simple calculation based on these data would give the following set of formulas, in which w = the maximum weight of steam made per hour, h = the area of heating surface, g = that of the grate surface, and c = the maximum amount of coal burned per hour.

$$A = \frac{0.5\,w}{p+10} \quad \ldots\ldots(1.)$$

$$= \frac{2.5\,h}{p+10} \quad \ldots\ldots(2.)$$

$$= \frac{62.5\,6}{p+10} \quad \ldots\ldots(3.)$$

$$= \frac{4\,c}{p+10} \quad \ldots\ldots(4.)$$

For boilers having different proportions, as locomotive boilers with their tremendous forced draughts, or some stationary and marine boilers with their vastly greater proportion of heating to grate surface or to steam made per hour, special rules must be constructed if the designer wishes to base his calculations upon their dimensions. As has been shown above, it is very easy to make such rules, the first of the set having been determined upon. No intelligent engineer will attempt to apply rules like Nos. 1, 2, 3, or 4 to exceptional cases, or, indeed, to use them at all without knowing upon what authority and upon what kind of practice they are based.

Rules in which the steam pressure is not taken into account are only applicable to some one pressure. The same caution is to be observed in using them. It is further evident that rules and formulas are not to be compared except where they are adapted to the same set of conditions as in the example just given.

Very large boilers require such great area of opening for their safety valves that it is necessary to divide it between two valves; in fact it is always much better to have two valves, even on small boilers. If an accident happens to one, the other is then to be relied upon, usually, to discharge the steam.

The forms of safety valves are almost numberless. A description of some of the best is to be found in the report of the committee on tests of safety valves, appointed from the U. S. Board of Supervising Inspectors of Steam Vessels, in 1875. Among the very best is the ordinary "Lever Safety Valve," of Papin, as modified by the introduction of knife-edged bearing pins by that committee. An excellent little treatise on the safety valve was published in the *R. R. Gazette*, in 1875, by Mr. R. H. Buel and reprinted in Van Nostrand's "Science Series," No 21. It gives a tolerably complete summary of the principles involved in the design and construction of this most important of all the attachments to the steam boiler.

Fluctuations in Pig Iron — Benner's Prophecies.

Perhaps of all natural products that form part of commerce—mineral, animal and vegetable—iron is the strongest element of general business. The most enlightened countries use the most iron per head of their population, while among barbarians its use is confined to the narrowest limits. When the price of iron is high—that is, when it sells at a large profit over the cost of production and marketing—general business is always prosperous and labor finds steady and remunerative employment. On the contrary, when iron is so low that its production is attended with no profit at all, general business languishes and labor suffers its worst. This has invariably been the case during the whole history of the United States for forty years past, or ever since iron-smelting became one of our most important industries. Fluctuations in the price of iron during this period give material for an interesting study. Looking over a table of yearly average prices, at Philadelphia, of No. 1 Anthracite foundry iron as compiled by the American Iron and Steel Association, since 1844, we notice that the lowest average price in any year up to the present was in 1861, \$20¼; the highest price was 1864, \$59¼. The very lowest average monthly price was in October, 1861, when it was \$18⅜, which is about the average at the present time. In 1872 we find the price \$48¾, from which figure it has declined steadily for five years, until it now stands the lowest ever known. Those most interested in pig iron are anxiously inquiring into the probabilities of its declining still more. With over two-thirds of the 7—— blast furnaces in this country standing idle, and the greater number of those in blast struggling to pay expenses, this inquiry is one of exceeding interest. During the last four or five months the prices of Anthracite pig iron have been very irregular; but, as a rule, have resisted the tendency towards further decline, and the demand has been about equal to production. Furnace owners are declaring (with more firmness than one or two years ago) their intention to blow out entirely rather than accept any further reduction. There is a glimmer of light ahead, a better demand for foundry use being already discernable. But as soon as any strong advance takes place, coupled with an accelerated demand, from 200 to 500 furnaces stand ready to receive a charge, fire up, and glut the market with a large over-production. It will evidently require a great awakening of the dormant industries of our country to create a safe demand for the product of all these furnaces, if indeed we are ever to have such a demand. Consolation may be found in the fact that advances in prices have been more than twice as rapid as declines, and that as soon as the upward grade is reached extensive industrial enterprises are launched forth, requiring large quantities of iron. But when shall we reach that upward grade? So far as we know the only man that has attempted to give a positive and definite answer to that question is Samuel Benner, a farmer, of Bainbridge, Ross county, Ohio, who in 1875 wrote a little book called "Benner's Prophecies of Future Ups and Downs in Prices," treating of pig iron, hogs, corn, provisions and panics. The book is a peculiar one and has been widely read and commented upon. Many well-posted ironmen who, when the book was published over two years ago, characterized it as an absurdity, are now pinning their faith to the arguments therein laid down. Starting with the assumption that "history repeats itself" in prices as well as in other things, Mr. Benner in 1875 wrote the following remarkable predictions on pig iron:

PREDICTIONS.

"I predict that the average price of No. 1 foundry charcoal pig iron in the markets of our country will be lower in the year 1876 than in 1875.

"I predict that the average price of No. 1 foundry charcoal pig iron in the markets of our country will be lower in the year 1877 than in 1876, and that the daily price in some months of that year will run below twenty dollars a ton.

"I predict that the average price of No. 1 foundry charcoal pig iron in the markets of our country will be higher in the year 1878 than in 1877.

"I predict that the average price of No. 1 foundry charcoal pig iron in the markets of our country will be higher in the year 1879 than in 1878, notwithstanding the resumption of specie payments.

"I predict that the average price of No. 1 foundry charcoal pig iron in the markets of our country will be higher in the year 1880 than in 1879.

"I predict that the average price of No. 1 foundry charcoal pig iron in the markets of our country, will be higher in the year 1881 than in 1880, and that the daily price in some months of that year will run above fifty dollars a ton.

"The average prices as determined for the 'American Iron and Steel Association.'"

The course of reasoning that Mr. Benner adopts as the basis of the above very positive and definite predictions, is deduced from a comparison of high and low priced periods or "cycles" since 1834. We quote further from his book.

"It has been within the experience and observation of the writer and as for himself requires no authority for the information that the price of pig iron was very high in the years 1837, 1845, 1854, 1864 and 1872 and that these years were the highest priced years since 1834; and also that the iron trade was severely depressed in the years 1834, 1843, 1850, 1861 and 1870, and that these years were the lowest priced years since 1834.

"Now we have our data; having traveled over the facts in the voyage of discovery and secured our evidence, let us form our cycles and see if we can make out a rule. Commencing with the low priced year 1834, we have stated that the price advanced three years to 1837, declined six years to 1843 making a cycle between low prices of nine years. Again the price advanced two years to 1845 and declined five years to 1850, making a cycle of seven years. Again advancing four years to 1854 and declining seven years to 1861 it makes a cycle of eleven years. Again advancing three years to 1864 and declined six years to 1870, it makes a cycle of nine years. Again advancing two years to 1872 it declines three years to 1875.

"It will be noticed that the years of advances are as follows: 3, 2—4, 3, 2. The declines are 6, 5—7, 6 and 3, up to the present denoting that the present declines are not full by two years of which it is necessary to have a cycle of seven years in its order between low prices. Unless history in detail does not repeat itself, the future cannot be judged by the past, and all human calculations as to cyclical movements in prices are as naught, and there is not anything sure and certain for man at the present day and age but death and taxes."

We have so far but three years of decline from the high prices of 1872, and if the cycle of seven years, from 1843 to 1850, is to make its periodical return and be repeated in its natural order of two years of advance and five of decline, then the cycle of seven years between low prices in its order is to be filled up from 1870 to 1877 and, therefore, we must have two years more of decline after 1875 to fill up the cycle, and we have no doubt but that "history will repeat itself" here as it has done in other cycles, which will varify and establish the accuracy of our prophecy.

SCALE OF ADVANCES AND DECLINES.

The Past.

Ups.		Downs.	
	1835		1838
3	1836		1839
	1837		1840
		6	1841
			1842
			1843
	1844		1846
2	1845		1847
		5	1848
			1849
			1850
	1851		1855
	1852		1856
4	1853		
	1854	7	
	1862		1865
3	1863		1866
	1864		1867
		6	1868
			186
			1870
	1871		1873
2	1872		1874
			1875 5

The Future.

	1878		1876
	1879		1877
4	1880		
	1881		1882
			1883
			1884
		7	1885
			1886
			1887
			1888
	1889		1892
3	1890		1893
	1891		1894
		6	1895
	1898		1896
2	1899		1897

"Since 1834 and including 1875 the price of pig iron has declined twenty-seven years, and advanced fourteen years, making the ratio of declines to the advances as two to one.

"The present cycle, ending in 1877, will complete five cycles in low prices since 1834; the five cycles in high prices will be completed in 1881. The return of the commencement of the different cycles in their periodical order, is twenty-seven years, one-half the ordinary life-time of man.

"In the year 1878 we shall enter a new series of ups and downs; the advances commencing with four years and declines with seven years making a cycle of eleven years in low prices. Also we are now in the cycle of nine years in high prices, and in 1881 the present high priced year cycle will be complete and end. And after 1881 we shall enter the cycle of ten years in high prices completing this cycle in 1891.

"We have in the beginning predicted that the daily price in 1877 will run below twenty dollars a ton and in 1881 above fifty dollars a ton. The inspiration that directs this prediction is found in the fact, that "one extreme invariably follows another," and that the daily price runs below twenty dollars in all the low priced years, and above fifty dollars in all the high priced years."

We have quoted at such length from the contents of Mr. Benner's book because the above table is made up in a very logical manner and the prophecies written by him over two years ago have thus far been in course of remarkable fulfillment. If the peculiar succession of high and low priced years is to continue after 1877, as it has done in the past, we must soon see an advance and now is the time to invest capital in the iron industry, so as to make money during the four years of advancing prices. At all events the table is worth studying as presenting new material upon which to prognosticate future flutuations in prices of iron. Just now it looks very doubtful about Anthracite pig iron reaching \$50 a ton in 1881, though certain brands of charcoal iron may exceed that price. Should the year 1878 result as predicted in this book, Mr. Benner ought to have a gold medal awarded him by the joint action of the leading scientific societies of the United States for his wonderful and valuable discovery.

THE BALDWIN LOCOMOTIVE WORKS. — *A Heavy Order from Russia.*—Early last month the agent of the Baldwin Locomotive Works, residing in St. Petersburg, sent a cable dispatch to the firm in Philadelphia, stating that the Imperial Government required a large number of locomotives at once, and asking whether the Baldwin Works could furnish forty first-class engines by February, 1878. Mr. Charles T. Parry, one of the company, at once sailed for Russia to see about the matter, and to secure the contract if possible. The result of his visit was an order received from Mr. Parry, on Monday last, for the works to proceed at once to build forty of the largest sized first-class freight engines of the five-foot gauge, to be completed during February and March, 1878.

In a letter received by the firm from Mr. Parry, a few days ago, he stated that the Russian Government has absorbed nearly all the railway plant for war purposes, and that it is being rapidly used up and destroyed in that ruinous service. Meanwhile the largest crop of wheat ever raised in Southern Russia and Bulgaria is rotting in the bins for need of transportation. This wheat, which usually finds an outlet from the Black Sea ports, will have to be transported by rail to the Baltic ports, and about three hundred new engines will be required at once. A large proportion of these will, however, be built in Europe.

The value of the forty engines to be built at the Baldwin Works will be over half a million dollars About eleven hundred men are now employed in the works, but this order will necessitate a large addition to the force, and from seven to eight hundred additional men will be taken on as the work proceeds.—*Philadelphia Ledger.*

A recently established and prosperous firm in the machinery trade of Philadelphia is that of Pinkerton Bros., corner Fourth and Arch streets. They are the selling agents there of the widely-known Hancock Inspirator, and report a very good trade in this excellent boiler feeder—selling about \$2,000 worth per month already, notwithstanding the fact that their agency is of very recent date. This firm also deal in steam engines, steam pumps, and all kinds of farming machinery.—*Commercial Bulletin.*

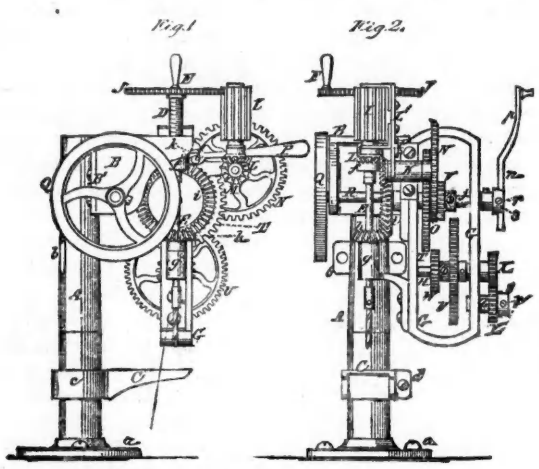
NEW PATENTS.

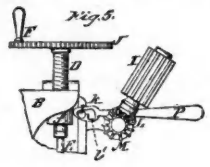
IMPROVEMENT IN METAL-DRILLING MACHINES.

Specification forming part of Letters Patent No. 195,993, issued to MARTIN L. EDWARDS, of Salem, Ohio.

These improvements are designed with special reference to upright drills for drilling metal, the object being to produce a machine adapted to all classes of work, and to render it unnecessary to manufacture but one size machine, and to supply all the wants of metal-worker using a hand-drill.

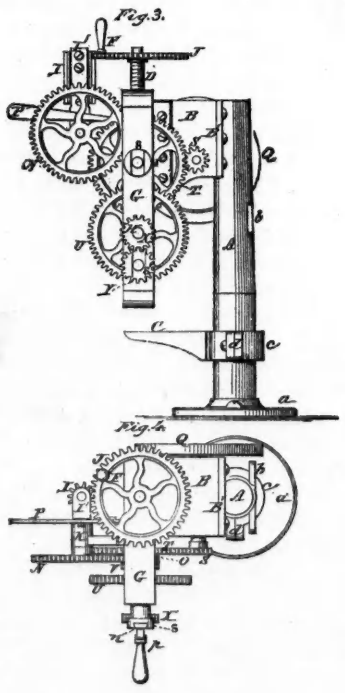
The operating parts of the drill are carried by an overhanging head mounted upon a fixed column. A supplemental frame depending





METAL DRILLING MACHINE.

from the head supports the bearings for the driving-shafts and the gearing by which to change the speed of the drill-spindle. A feed device of novel construction and adaptation effects a continuous feed of the drill-spindle, and its relation to the latter and the connecting-gear of the main shaft is such as to give the operator control of the feed by the simple adaptation of a long pinion, so as to engage with a hand-wheel gear of the spindle, and to be swung out therefrom to stop the feed, such adjustment and the holding of the long pinion



METAL DRILLING MACHINE.

in gear being effected by a lock catch-lever, or equivalent device.

The driving-power may be applied to either of the shafts of the supplemental frame, and any desired motion obtained.

A fly-wheel is arranged and adapted to have a much faster motion at all times than that of the drill spindle, which gives an important advantage in the working of the machine.

Referring to the drawings, Figure 1 represents a side elevation of a drilling-machine embracing the invention; fig. 2, a front elevation; fig. 3, the gearing side of the machine; and fig. 4, a top view of the same. Fig. 5, is a view showing the long pinion locked out of gear.

In the construction of the upright drill, there is employed a cylindrical column, A, which may be solid or hollow, and is provided with a base bearing, *a*, for attachment to a bench, or a side bearing, *b*, for attachment to a post or the wall, as may be desired, and a head, B, for supporting the working parts of the drill.

The head is bolted to a vertical flange, B', at the top of the post, and the side-bearing is secured to the rear side of the column.

A table, C, capable of horizontal and vertical adjustment upon the lower portion of the column, supports the work to be drilled, and it is secured to said column by a clamping-eye, *c*, split at one side, and with a clamp-screw passing through eye-extensions, *d*, by which said table is clamped to any position desired, with respect to the bit and the character of the work. The lower portion of this column is made a true cylinder, to allow the clamping-eye to be moved up and down, and the table to be turned to either side and swung out to remove or place the work thereon.

The feed-screw, D, of the drill-spindle, E, is provided with a left hand thread, and passes through a screw-threaded boss, *f*, projecting down from the head a hand feed-wheel, F, being secured to the upper end of the feed-screw, and the lower end of the spindle is provided with the usual socket for the bit.

A bracket, *g*, supports a bevel-pinion, *h*, fitted by feather and groove upon the drill-spindle, so that the latter is free to move through the pinion, and a bevel-gear, *i*, upon the inner end of a horizontal driving-shaft, *j*, matches with and drives the drill-spindle pinion.

A supplemental frame, G, is firmly bolted to the side of the overhanging end of the head, and the driving-shaft extends through and has its bearings in this frame, which also carries a lower auxiliary shaft, H, and these two shafts carry adjustable gear-wheels, so arranged as to admit of any desirable number of changes of speed that may be required to adapt the machine to every variety of work and to adapt the auxiliary shaft for use as the driving-shaft whenever it is necessary to obtain an increased speed for light drilling, or a reduced speed for heavy drilling, as will be presently more fully stated.

The supporting-bracket, *g*, for the drill-spindle pinion is bolted to the lower portion of this supplemental frame, and the framing of the drill is thus rendered compact and durable.

The drill-spindle has a continuous feed produced by a novel device, and the connections thereof with the main shaft are such as to give a feed in harmony with the increased or diminished speed of the drill-spindle. This feed device consists of a long pinion, I, adapted to mesh with gear-teeth, J, on the circumference of the hand feed-wheel, and is mounted in a carrier, I', the lower end of which has its bearing upon a short shaft supported in a bracket, K, bolted to the front side of the head, contiguous to the supplemental frame. Upon this short shaft the long pinion is capable of being swung toward and from the hand feed-wheel gear to engage and disengage the feed.

A bevel-pinion, L, at the lower end of the long pinion, meshes with a like pinion, M, on the inner end of the short shaft, while a cog-gear on the outer end of the said shaft meshes with a pinion, O, on the main driving-shaft, *j*, and thus drives the long pinion, and, through it, the spindle hand-wheel, which thereby is maintained in gear as the bit is fed down, the length of the pinion being equal to the vertical feed of the spindle.

A lever-catch, P, pivoted to the long-pinion frame, I', engages, by its inner lock-slotted end, *k*, (see fig. 5,) with a pin, *l*, on the head, and holds said pinion in gear with the spindle-wheel, the lock, *l'*, of the slot being such as to be detached from the pin by raising the end of the lever and pulling it forward, so that the long pinion can be put out of gear and the feed stopped. In this in-and-out movement of the long pinion its frame and bevel-pinion move concentric with the short shaft, which gives motion to said long pinion. This device gives a very easy and quick control of the feed at all times, and a regular and uniform feed.

The fly-wheel, Q, has an increased motion given to it over the drill-spindle during all or any of the varied motions or changes in the speed of the drill-bit. This is obtained by the arrangement of the fly-wheel upon an independent shaft, R, having its bearings in the sides of the head, and a pinion, S, which gears into a large gear-wheel, T, on the main driving shaft, so that the fly-wheel has a much faster motion at all times than the drill-spindle, which gives a much easier and steady motion.

To secure any desirable speed for the drill-spindle, the auxiliary shaft H has a large cog-wheel, U, fixed thereon, to engage with an adjustable pinion, V, on the main shaft, *j*, and give a high speed, while an adjustable pinion, W, on the auxiliary shaft is adapted to engage with a large gear-wheel, T, on the main shaft, and give a reduced speed. These pinions are fitted to feathers, to prevent them from turning on their shafts, and are provided with thumb-screws, *m*, to hold them in place when out of gear.

To adapt the auxiliary shaft H as a driver, its outer end is provided with a pinion, X, which meshes with a similar pinion, Y, on a stud, Z, to which the crank or other power is applied.

When hand-power is used the end of the main shaft and the face of the pinion Y are provided with grooved heads *s s'*, to receive the shank *n* of the crank-handle *p*, in the manner of a dovetail, and fastened by thumb-screws *r*, so as to be lengthened or shortened to suit different classes of work.

The drill may be run by power by lengthening the shafts and placing thereon a pulley instead of a crank.

The fly-wheel can be driven by a spur-gear attached to or made intregal with the large bevel-gear *i*, which drives the spindle. When the drill is run by the main shaft *j*, the supplemental shaft is out of gear.

In changing the gear for the different motions, the pinions only are moved; but the large wheels may be made adjustable, if desired, and the gears may be so arranged as to admit of any desired number of changes of speed that may be required

The long pinion is swung out from the hand-wheel gear when it is desired to raise the drill-bit, as shown in fig. 5.

Claim—

1. The combination of the long pinion I with the drill-spindle D E and gear F, said long pinion being arranged upon a pivot coincident with the axis of its driving-gear, and upon which it is swung into and out of gear with the spindle, to adapt said long pinion to feed and stop the feed of the drill-spindle, as herein set forth.

2. The long pinion I and its pinion L, arranged upon a pivot coincident with the axis of the driving-pinion M, in combination with the feed gear-wheel J, the drill screw-spindle D, and its driving-gear *h i*, substantially as herein set forth.

3. The combination, with the long pinion I, of the pivoted carrying-frame I', the shifting-lever P *k*, and the locking-pin *l*, adapted for operation as set forth.

4. The combination, with the long pinion I, pivoted for adjustment, as described, of the gear N, the separate shafts *j* H, their driving-gears, the separate dovetail socket-heads *s s'*, and the outside pinions X Y, all constructed and adapted for operation with the crank-handle *p*, as set forth.

IMPROVEMENT IN SCREW-CUTTING DIES.

Specification forming part of Letters Patent No. 195,713, issued to M. CARLYLE JOHNSON, of Hartford, Connecticut, assignor of one-half his right to William M. Woodruff, of same place.

Like letters in the figures indicate the same parts.

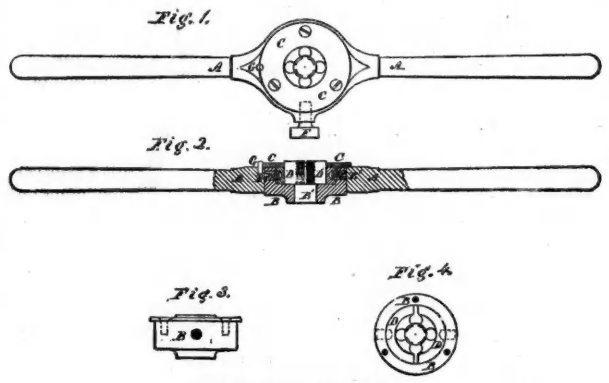
This improvement relates to dies for cutting screw-threads, more especially such as are held in die-stocks for use by hand; but parts of the invention are equally applicable to dies that can be used in machines without being attached to the ordinary die-stock.

This invention has for its object a simple and more effectual manner of securing the detachable cutters into the collet which holds them when in use, and also a better method of holding the collet in the die-stock.

This invention consists in the peculiar construction and arrangement of the several parts, that will be hereinafter described.

In the accompanying drawing, Figure 1 shows a top view of the improved dies inserted in the die-stock. Fig. 2 shows a longitudinal section through the middle of the die-stock, showing also the parts of the cutters beyond the section through the middle. Fig. 3 is a side view of the collet containing the cutters removed from the die-stock. Fig. 4 shows a top view of the collet and contained cutters, with the top plate removed so as to show the interior parts.

A is the die-stock, which is furnished with a circular opening for a cylindrical collet B.



SCREW-CUTTING DIES.

The collet B has a cylindrical recess in its upper part for containing the cutters D and D', and an opening, B', through the bottom for the passage of the bolt upon which a screw-thread is to be cut.

C is a plate or cover upon the top of the collet B, secured to it by means of screws, as shown in figs. 1, 3, and 4. This cover extends over the central cylindrical opening in the collet B, and rests upon the outer portion of the cuttters D and D'. It also extends beyond the outer circumference of the collet, and rests upon the top surface of the die-stock when the parts are in position for use.

D and D' are the cutters, or parts which form the thread upon the bolt. Their exterior is of a semicircular form, and fits into the recess in the upper part of the collet B. The central portion of these cutters extends upward through the opening in the middle of the cover C, so as to reach a short distance beyond its upper surface, for the purpose of cutting a thread close down to a shoulder or enlargement of the bar, and the outer or rear portion is clipped under the inner edge of the cover, for the purpose of holding them firmly in place. The height of this rear portion of the cutters is made a little greater than the depth of the recess in the collet, so that the cover shall bear upon the cutters and leave a small space between the cover and the collet. When the cover is forced down by means of its screws, the cutters are firmly clamped in place.

To adjust the cutters to an exact position to allow for wear, or for any cause to vary the diameter of the screw cut, they are provided with the adjusting screws E and E'. These turn in threads in the outer shell of the collet B, and enter suitable recesses in the backs of the cutters, so as to press them inward when desired.

The position of the cutters can be adjusted at any time by slightly loosening the screws which hold down the cover C, and then turning the screws E E'. The cover can then be again screwed down and the cutters clamped in their new position.

F is a thumb-screw for securing the collet and its attached parts into the die-stock. It passes through a hollow thread in the die-stock and enters a recess in the collet. The inner end of F, which is intended to hold the collet from turning when in use, as well as to secure it in the die-stock, is preferably made without a screw-thread, and of a slightly taper form, so as to entirely prevent any lateral movement.

By means of the invention several sets of cutters of different threads can be used in the

same collet, and several different collets can be used in the same die-stock, and all can be readily and easily interchanged and replaced when desired.

Claim—

1. The combination of the collet B, the cover C, the cutters D D′, and the adjusting-screws E E′, when constructed and arranged substantially as and for the purpose herein described.

2. The combination of the covering-plate C, the cutters D D′, and the collet B with the die-stock A, and a suitable mechanism for adjusting and securing the collet in the die-stock, substantially as herein described.

Smith's Boiler Furnace.

The problem how best to obtain the fullest advantages of the coal burned in a boiler furnace has given rise to numerous inventions, the one herewith illustrated having shown some very good results in several situatinos where it has been applied. The cut represents the Economy wrought iron furnace applied to an ordinary tubular boiler. B B, B B are the steam-generating columns which form the side walls of furnace, connected to top of boilers or steam-dome by pipes N N and O, and at bottom with manifolds E. They occupy the place of usual 4″ lining of fire brick. C is wrought-iron drum forming bridge-wall connected with manifolds E by pipes G, and manifold I at rear of boiler by several pipes H H. Manifold I is connected to boiler by pipe K, arranged to provide for expansion and contraction in pipes H H. Manifolds E are connected with boiler by pipes F F, for circulating. Pipes L, one on each side, connecting boiler and bridge-wall C, are for same purpose. In the front end of manifolds E are brass plugs M for cleaning out, when necessary. Hand-holes P are also put in bridge-wall C, and tees and plugs at angles in pipes H, for same purpose. The blow-off cocks Q are located at back end of manifolds E. The boiler is fed at R. It will be noticed that the most prominent feature of this furnace is the largely increased fire surface which it adds to a boiler. From 150 to 200 feet of fire surface is added to every boiler it is applied to and allowing 4 feet of fire surface to each horse-power, it should enlarge the capacity of a common 35 horse-power boiler to a 50 horse-power boiler. This would be equivalent to substituting a 5 foot boiler for 4 foot one..

There is generally a large waste of heat with boilers set in brick-work, the brick sides absorbing much that should go to make steam. In Smith's furnace the side walls are 16 columns, each having a complete dome at the top, and sending the water through a 2-inch pipe from each set of columns. The bridge wall is of wrought iron, 7 or 8 feet long, presenting about 12 feet of fire surface to the fire in the hottest part of ths furnace. A bridge wall of brick takes up and wastes much of the heat, which is here made available. Again, the ash-pit or space back of the bridge wall, frequently allows a good portion of heat to escape. In this furnace the full heat is utilized by having a row of pipes running through to the back end of the boiler. They are screwed into the bridge wall ,and are 1½ inches apart and connect with a steam drum at the extremity of the boiler. The drum connects with the boiler through a 2-inch pipe. Rapid circulation of water removes any scale from a boiler and deposits it in the manifolds, where it is easily cleaned out. Scale is also prevented from forming by the rapid circulation. This constant free circulation renders the boiler in a great degree safe from danger of explosion. The furnace is in use by several manufacturers who are well pleased with it. It is manufactured by C. D. Smith, the inventor, 86 John street, New York; also by the Economy Boiler Furnace Co., 265 South street, Philadelphia.

We give below the results of a series of trials made at the Cambria Iron and Steel Works, Johnstown, Pa., during September, October, and November, 1877, on two wagon top boilers, each 30 feet long, 48 inches in diameter, with two 16-inch flues, and to one of which the Economy Boiler Furnace was attached. These boilers were used on alternate weeks to drive the same machinery; the work varied, and on using the ordinary boiler an extra fireman was needed to force this boiler to do the work. That marked Economy had furnace attached. The figures given are those furnished from the works, and are the totals and averages for entire series of trials.

		Ordinary Boiler, with Economy Furnace.	Ordinary Boiler.
Duration of Trials	Hours.	257	229
Total water evaporated,	lbs.	772,366	601.085
" coal consumed	"	86,909	86,915
" refuse from coal	"	16,092	16,095
" combustible	"	70,817	70,820
Average water evaporated per hour.	"	3,005.3	2,624.8
Average coal consumed per hour		338.1	379.5
Average temp. feet water,	Degrees Fah.	52.2	54.9
Average pressure of steam	lbs. per sq. in.	43.8	43.1
No. lbs. water evaporated per lb. coal		8.88	6.91
No. lbs. water evaporated per lb. combustible.		10.9	8.48
Average coal consumed per sq. ft. grate surface.		18.7	21.8

No test was made of quality of steam, but from its use it was in favor of the Economy Furnace.

Queries and Suggestions.

(1.) X. Q. asks: What is the best flux for welding iron and steel? A.—The best mixture for welding iron and steel of which we have any knowledge is composed of about equal parts in weight of pulverized borax and filings of Norway iron. Care should be taken not to allow any grease or impurity to adhere to the iron. Ordinary wrought iron, or even cast iron will do, but not as well as Norway. The proportions of the mixure can be varied if desired, but in most situations the best results are obtained when the ingredients are of equal weights. In using this mixture *never heat above a cherry-red* or a great portion of its efficiency will be wasted. One advantage of the mixture is allowing a weld to be made at a lower temperature than with borax alone.

(2.) G. W. Francis, Middletown Conn., writes as follows: Having had a number of inquiries from different ones in regard to the annealing of cast steel I give the following as the only correct method to malleableize the carbon which the metal contains:

Heat in a hermetical vessel, such as a box with cover or pipe, to a red heat in twilight. The article to be annealed must be placed in the box or pipe, and this luted with c ay to exclude all air. Place the box and contents in a slow fire until the red heat is obtained, then cover up the whole in the fire until cold.

I think this method of annealing will meet the wishes of workers in this metal.

(3.) T. H. writes: How are twist drills tempered so as to give them that bright, clear appearance? Are they previously cleaned, or do they come from the tempering solution in that light state? (Any of our readers that can answer this question will confer a favor by doing so.)

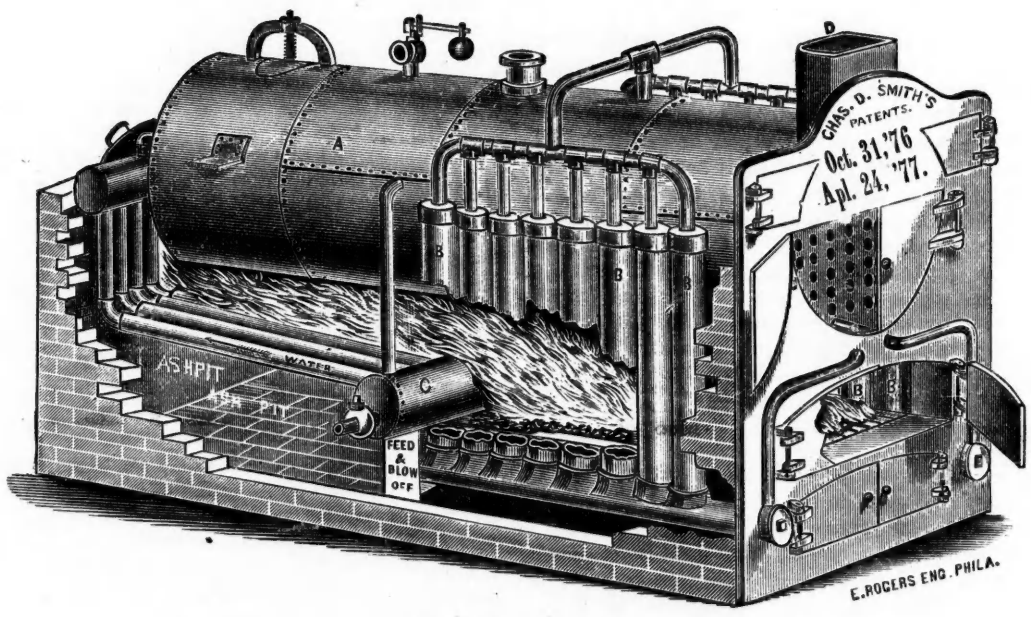
(4.) M. H. S. says: I wish to obtain some material to form a crucible that will retain the action of borax at white heat (15,000° to 22,000°) in a fluid state—something that will withstand the borax without chemical action. I have tried plumbago crucibles, Bangfaugh crucibles, German Hessian crucibles, Missouri clay crucibles. German clay crucibles, and our domestic clay crucibles, besides special combination crucibles; but none will stand the ordeal. A. Try the Storbridge clay crucibles. They are imported from England, and are largely used in the manufacture of steel.

A company in this city is now beginning to introduce an attachment for ordinary steam boilers which is claimed to double the capacity of any boiler it is applied to. The company offer to put up $1,000 against $250, which they will forfeit if a boiler provided with this attachment does not evaporate 12½ pounds of water per pound of coal, steadily during a complete day's running. We shall look for developments and keep our readers informed of any extraordinary and well authenticated results.

Prof. D. T. Ames, publisher of the *Penman's Art Journal*, has just published an elaborate compendium of practical and ornamental penmanship, which was commenced about two years since. Not having space in our present issue, we will review it in our next.

Anderson & Passavant, Pittsburg, are hard at work turning out about two car-loads of wire each day on their contract for the East River Bridge, New York. Having leased the old mill of Wharton & Co., they are running it to its full capacity in wire rods exclusively.

The new mill on Second avenue is ready for operation. Their works are about the busiest in the city.



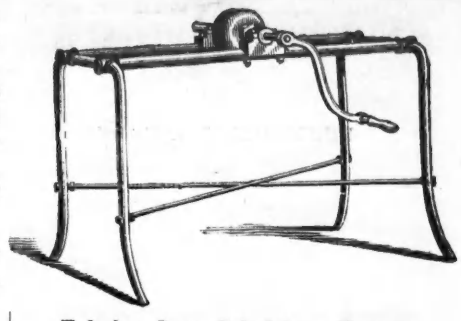
SMITH'S BOILER FURNACE.

Patents.

We extract from the records of the Patent Office the names of a few mechanical patents issued during the past month:

Belting machine, C. Kohsel	196,911
Boiler tube cleaner, W. Dunn	196,642
Governor for steam engines, etc., E. A. Sutcliffe	196,947
Iron and steel, M. A. Sutherland	196,547
Lubricator, G. H. Fowler	196,650
Lubricator, F. Collignon	196,742
Mechanical movement, W. A. Stutphin	196,957
Mechanical movement, A. S. Tood	196,842
Pump, oscillating, G. R. Winkler	196,732
Punching or shearing, Gooder & Lavin	196,576
Pulp engine, S. L. Gould	196,752
Pump, force, J. Tallent	196,953
Steam boiler, duplex, J. B. Rivera	196,597
Steam generator, T. F. Butterfield	196,559
Sucker rod adjuster, W. H. Curtis	196,564
Screw threads, forming female, T. F. Woodward	196,733
Screw threads, cutting, A. H. Siegfried	196,710
Shafting, clutch coupling for, N. Beauregard	196,516
Steam engines, condenser, J. Haupt	196,902
Steam generator, Renshaw & Tower	196,825
Steam trap, C. F. Pike	196,764
Traction wheel, W. H. Trenwith	196,843
Wire-drawing machine, J. S. Winsor	196,963

There is a growing South American trade for small tools for machine shops, and for hardware specialties.



Tubular Iron Grindstone Frames.

The above cut represents a very neat, light, but strong, style of grindstone frame, made by Torrance, Merriam & Co., Troy, New York. They are made of gas-pipe, and the parts made interchangeable and by removing the two brace rods, the legs can be folded together, so the frames will not take the usual room for storage and shipping. The frames can be shipped at less expense for freight charges. They are adapted for either power or hand use, and are particularly desirable for use in warm latitudes, where wood decays rapidly.

The Portable Engine of the Future.

We make the following extracts from an article in the *Engineer:*

We have good reason to believe that the demand for portable engines to be used in Great Britain, which has been becoming smaller and smaller for some time past, will soon cease almost altogether. The only engines of the kind which will be built in a not distant future will be sold in foreign markets or purchased for home use solely by builders and contractors. This statement—will hardly take any of he great agricultural engineering firms by surprise, however startling it may appear to others. But no alarm need be felt; an important branch of trade will not be cut off. The place of the portable engine will be filled by a kindred machine in the production of which profits may be made and a large business done. In order that we may understand what this machine will be—what, in a word, is to take the place of the portable engine—we must consider the nature of the circumstances which have led to the change. In Great Britain portable engines are bought—putting contractors on one side—by two distinct classes. One of these consists of men farming large tracts of land and possessing two or more homesteads, often some miles apart. These agriculturists use the portable engine almost exclusively for threshing; and the engine and machine have to be moved from farm to farm. The removal will require, on an average, the services of six horses—four to draw the engine and two to draw the threshing machine. The horses are taken for this purpose at a time when every hour is of importance to the farmer who wishes to get his land ploughed, or his roots led home; and this the owner of the engine, machine and horses regards as a very serious evil. The second class of British purchasers consists of men who either hold no land, or very little. They invest some hundreds of pounds in the purchase of one or more sets of thrashing machinery, and they make a livelihood by hiring them out to farmers who do not grow corn enough to give employment for more than a few days in the year to a thrashing machine. The rule is that each hirer of the set shall send his horses for it to the place where it was ast employed.

If the tiller of hundreds of acres grumbles at the loss of the services of six horses for a day or two, how much more in convenient must the loss of his teams prove to his poorer neighbor? The difficulty of the case is of course augmented when, as sometimes happens, the small farmer has not got six horses to send for the engine and threshing machine. So long as there was no help for this state of affairs the farmer had perforce to submit. But he has not been blind to the fact that certain owners of the machinery which he wanted did not use portable, but traction engines.

AMERICAN MACHINIST

PUBLISHED MONTHLY

BY

MILLER & BAILEY,

Editors and Proprietors.

88 Warren Street, New York.

H. B. MILLER. JACKSON BAILEY.

Edition, 5,000 Copies.

SUBSCRIPTION.

$1.50 per year, in advance. United States Postage prepaid.

To Foreign Countries, $1.50, postage added.

ADVERTISING.

Outside page, 35c. per line, each insertion.

Inside pages, 20c. per line (12 lines one inch).

BRITISH AGENCY.

HAMMOND & Co., 5 Grocers Hall Court, Poultry, London, will receive and forward subscriptions and advertisements on our regular terms.

EDITORIAL ANNOUNCEMENT.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

NEW YORK, DECEMBER, 1877.

Those who receive a specimen copy of this second issue of the AMERICAN MACHINIST will oblige us by examining it carefully. If it is the kind of paper you want, send us your subscription for 1878.

Extravagant Guarantees.

We, as a nation, have fallen into a kind of confirmed habit of exaggeration, and our foreign friends have accustomed themselves to take any wonderful statement in an American newspaper with an allowance for elasticity. In mercantile transactions caution is an element of increasing importance, and in new enterprises the Mulberry Sellers family show their hands quite as often, if not as heavily, as in the palmy days of inflation. Schooled by the collapse of many a promising bubble and the large shrinkage of anticipated results in ordinary business transactions, which always were mapped out with positive and plausible assurance by the "party of the first part," even the shrewdest and most calculating of men hesitate to risk their substance where failure in ultimate results would work irreparable or serious loss. Before making an important purchase it has become the fashion of the day to ask for strong specific guarantees on the part of a responsible seller, and the greater the guarantee the more likely is the average purchaser to loose his purse strings. In no other branch of trade is there more spirited competition in offering guarantees than with manufacturers of machinery, engines, boilers and their attachments. It is becoming rather unusual to bring out a new steam engine, boiler, boiler furnace, grate bar, damper regulator, feed water heater, governor, valve gear, piston packing or lubricating device that is not "warranted to save from 15 to 25 per cent. of the fuel," and furthermore it is a rare exception that these open assurances are not reinforced by certificates from parties having these wonderful economizers in use, testifying to their efficiency and ability to do all that is claimed for them. We have a collection of manufacturers' circulars of engines, boilers and appurtenances, each claiming to effect a certain specific saving of fuel, and accompanied by certificates averring that the saving claimed has actually been demonstrated from which we can select one engine, one boiler and "fixin's" for both, that taken together sum up a guaranteed saving of 425 per cent. of fuel! Here are the figures, and "figures won't lie." Now what is the use of burning any fuel at all, when it is so directly shown that by purchasing these few patent economizers not only every pound can be saved, but a rapid accumulation effected. The reply of the Irishman who was solicited to buy a new stove upon the assurance that it would save him half the fuel, is suggestive; "Faith," says the son of Erin, "then I'll buy two of them and save it all." Seriously considered it is not easy to determine what weight these guarantees should have with the prospective purchaser. There are so many peculiarities in the use of steam in different situations that what advantage could be gained in one situation by the adoption of any particular invention would not be manifest in another where the circumstances were different.

To illustrate, suppose a certain style of governor effects beyond question an economy of 10 per cent. on a saw mill engine, this does not prove that it would show an equal advantage on a flour mill engine. We might inquire whether these certificates of fuel saving, and unusual efficiency are not sometimes stretched a point or two in order to give them additional strength. Engineers are often influenced by a desire to accommodate a manufacturer of patent boiler furnaces, etc., into giving him extraordinary testimonials, and proprietors of establishments generally give certificates upon the representations of their engineers, superintendents and foremen. Purchasers are inclined to yield to a line of argument well iterated and persistently followed, and as these guarantees are laid before them in a "childlike and bland" manner, it is not unfrequently the case that the party guaranteeing the greatest saving in fuel or the greatest advantage in any other way secures the order entirely on the strength of these assurances and goes on his way rejoicing. We say rejoicing because the skillful and experienced introducer of patent fuel and labor-saving inventions knows that in fully nine cases out of ten, when the new machine, engine or boiler is placed at work and performs its part without mishaps or drawbacks, the purchaser pays for it without gauging exactly the saving over the displaced article in order to test the fulfilment of the guarantee. To cover a possible contingency, and guard against loss upon customers who apply mathematical rules in testing results obtained, the utterer of extravagant guarantees generally fixes a selling price so high that he can afford to make a rebate from the sum named in the contract in case the customer detects a deficiency in promised results, and rebels against making full payment. It is folly to assume that no risk is taken in buying upon an extravagant guarantee. Is there no loss incurred in puting in a boiler, engine or piece of machinery that in a few weeks' use proves inefficient and has to be removed and another substituted? A little reflection will convince any one of the absurdity of contending that the risk is of no account. There is something radically wrong when preposterous guarantees are required in order to effect sales, and the manufacturers of motors and machinery that strenuously resist the invitation to compete in making such offers, will, in the end, secure the greatest public confidence and lasting success. Extravagant statements should be avoided, and when offered should be discountenanced by the purchaser. Let circulars be written in plain English, with moderation in the use of superlatives, and careful reservation in making claims.

The attention of all our readers owning steam power is directed to two articles written especially for this number of the AMERICAN MACHINIST; one on page 4, by Prof. R. H. Thurston, on "Sizes of Safety Valves," and one on page 10, by Theron Skeel, Engineer, on "The Methods of Setting Steam Boilers in Brick Work," The information contained in these two articles will be found both correct and valuable.

In our next issue we shall publish an article on the Injector Condenser, now in preparation for us by a practical, experienced engineer, also an article on lubricants, by a competent authority, embracing the results of some remarkable tests at the Stevens Institute and elsewhere.

Steam Boiler Commission.

Some four or five years ago a Commission, composed of prominent engineers and professional men, was appointed under United States Government auspices, to inquire into and report upon the causes of steam boiler explosions, and the sum of $100,000 was appropriated for the expenses of tests, experiments, &c. For a year or two public attention was directed to the work of this Commission, but latterly public interest in the undertaking seems to have died out, and indeed there has been nothing doing to keep it alive. A number of boilers were exploded at Sandy Hook, N. Y., and Pittsburg, Pa., under direction of the Commission, and altogether about $80,000 of the appropriation was expended, and the remainder some time since covered back into the Treasury. Some members of the original Commission have resigned (one of them, Prof. R. H. Thurston), leaving it as now constituted—Prof. J. D. Runkle, Chairman (Massachusetts Institute of Technology, Boston); C. W. Copeland, C. E., New York; J. R. Robinson, C. E., Boston; and Isaac V. Holmes, C. E., Cleveland, Ohio. We have lately conversed with two of the above-named gentlemen, and from them learned that no general report of operations and results has been prepared, though two partial reports have been made to the Treasury Department, neither of them containing much of interest or value to the public at large. The fact most strongly developed by the experiments undertaken, we are informed, is that we have more to learn about the causes of boiler explosions than has ever yet been found out, and that in many cases the causes assigned for an explosion by men who are supposed to be the most competent to judge are entirely erroneous, and therefore void of any value whatever. The Commission found great difficulty in obtaining pyrometers and other instruments suitable for use in their investigations. A set was imported for the purpose, but proved to be wanting in special requirements. It was, as a last resort, determined to make an instrument that would indicate exactly what is going on in any part of a boiler at any and every instant while conducting an experiment. After much study and labor, a very delicate electrical instrument has been devised and constructed by the Commission at their workshop n Boston, by means of which the investigators can remain secure in a bomb-proof retreat 300 feet, or any safe distance from a boiler, and see the internal condition of every part of the boiler indicated right before them with the greatest precision. One trouble with the instruments heretofore used was that they would not act instantaneously at a safe distance, and the exact condition of a boiler a moment before the explosion could not be observed. It is desired to know whether the water is solid in the boiler at the time of the explosion; that is, whether it is in actual contact with every part of the shell. The instrument devised will show this positively and satisfactorily.

Fine wires are arranged inside the boiler, passing over the plate very close to it, but not in actual contact, so that should the water be lifted even slightly from the plate so as to clear the wire at any point, the fact is instantly telegraphed to head-quarters and the precise location of the "lift" indicated by the instrument. Equipped with this new auxiliary the Commission declare themselves ready, if means be placed at their disposal, to grapple more successfully with the important problem they set out to solve, and to produce results of practical and permanent value. A few days ago they proceeded to Washington with the intention of laying before the heads of the Navy and Treasury Departments the question of future operations, in the hope that Congress may be induced to make another appropriation to go on with the work. As some of the members were taken sick they all returned home without holding a meeting. It is proposed to ask for an appropriation sufficient to carry on investigations one year upon the re-assembling of Congress in January. Several thousand dollars worth of property purchased by the Commission lies idle and useless at Pittsburg and Sandy Hook, and nothing can be done in the matter without Government action.

If this Commission can accomplish what it was constituted for, there should be no opposition to a liberal appropriation for whatever definite knowledge of a general character can be gained as to the causes and means of preventing those frequent and fearful boiler explosions chronicled by the daily press, with the attendant chapter of horrors in loss of life and limb, must prove a boon to humanity at large. Every year new and valuable discoveries are being made in the use of steam, but little progress is made in rendering its use more safe and assuring in the thousands of different situations where it is regularly employed. We have seen a very voluminous report made this year by an English Commission on Steam Boilers, but know not what beneficial information it contains. An ordinary engineer would probably require six months to a year to read and assimilate that report unless he should have abundant time at his disposal. What is needed are plain established facts in regard to managing boilers so as to insure safety—facts that can readily be placed in the possession of engineers and made available.

Our Reception.

The kind words we have received since sending out our first issue, in letters from all parts of the country, as well as the friendly notices by our brethren of the press, are particularly gratifying and will not soon be forgotten. Quite a number of subscriptions have been received through the mails, which, according to our observation, is very unusual upon the publication of but one number of a technical journal. It is our determination to maintain the character of the paper, and make each succeeding issue an improvement upon the last. We select a few notices from our exchanges:

(*From the Railroad Gazette.*)

"The AMERICAN MACHINIST, whose sub-title is "a journal for machinists, engineers, founders, boiler-makers, pattern-makers, and blacksmiths," is a new venture in engineering literature. It is to be a monthly publication, very nearly of the size of the *Railroad Gazette*, and is profusely illustrated, somewhat after the manner of the *Scientific American*. The appearance and make-up of the paper are very good, although some of the engravings have done duty "full many a time and oft" as advertisemets. The want which this new paper has undertaken to fill is one which has long been felt in this country and in which abundant success awaits the enterprise which supplies the want. The new paper is published by Messrs. Miller & Bailey, at No. 88 Warren street, New York."

(*From the American Grocer.*)

"The AMERICAN MACHINIST is a new venture in the journalistic world, published monthly by Miller & Bailey, 88 Warren street, New York. From their introductory we learn that independence and reliability are to be the watchwords of the publishers, who state that proposing to make the AMERICAN MACHINIST the standard machinery newspaper of America, they will give undivided attention to the paper, not being specially interested in the sale of machinery or other merchandise, or in the procuring of patent-rights, and not having any pet scheme to advance or hobby to ride. Starting so well, we trust that our friends will meet with abundant success."

(*From the Bulletin of the American Iron and Steel Association.*)

"A copy of the first issue of the AMERICAN MACHINIST has been received. This is a new monthly 16-page paper, started in November, 1877, by Miller & Bailey, No. 88 Warren street, New York, at the low rate of $1.50 a year. It is a technical journal, intended for machinists, engineers, founders, boiler-makers, pattern-makers, and blacksmiths. The November number presents a very creditable appearance, both in its contents and its mechanical make-up, and if its character is sustained, the paper will deserve and achieve success."

(*From the Pittsburgh Evening Chronicle.*)

"AMERICAN MACHINIST.—This is the title of a sixteen-page paper, published in New York, and devoted, as its name indicates, to machinists, engineers, and such as are engaged in vocations in which a practical knowledge of mechanics is essential to success. The first number presents a beautiful typographical appearance, and contains a number of interesting articles, among which that on "Wire Drawing," by Professor R. H. Thurston, is especially noticeable. Admirably illustrated descriptions of recent inventions render the MACHINIST as attractive as the *Scientific American.*"

(*From the Beaver Falls, Pa., Courier.*)

"How difficult it is to issue a sheet "without spot or blemish" no one can appreciate except a publisher, and yet a new periodical is lying on our table absolutely perfect. The AMERICAN MACHINIST, in its initial number, comes to fill a want long felt. It contains designs and articles upon new inventions, practical helps to the machinist, that he has ooked for in vain heretofore. It is published

by Messrs. Miller & Bailey, 88 Warren street, New York, at $1.50 per year. The MACHINIST is typographically a beautiful piece of work. A specimen copy, if sent for, will certainly result in a subscription."

We hardly comprehend the criticism of our esteemed neighbor the *Railroad Gazette*. If it means that our patrons have used the same engravings "many a time and oft" in their advertisements, it only proves that they are alive to the fact that the greater publicity given to their goods the greater will be the sale; if it means that the engravings shown in our reading columns have "done duty as advertisements," we cannot acknowledge the corn, for two-thirds of them were made expressly for the MACHINIST, and we cannot find that any of the remainder, although they may have been in print before, have ever appeared in advertisements. However, we are not averse to criticism, and will always be glad to have any faults pointed out, so they can be corrected. We are gratified to learn that several of our advertisers have already made considerable sales through their cards in the MACHINIST.

The Paris Exposition.

Our countrymen are proverbially slow to enter upon any important undertaking, but rapid in action after once making a start. The United States Government was the last in the world to formally accept the invitation of France to participate in the Exposition of 1878, and the people are just waking up to the importance of exhibiting their goods at this great display of the world's choicest productions of industry, science and art. It was erroneously given out, some weeks since, by those presuming to know the facts, that one thousand to fifteen hundred applications for space had been filed with the American Minister at Paris. We have just seen a list of all the applications received by that functionary, mailed by himself to a firm in this city, and the total is just fifty-three, a large part of them for space to sell soda-water, peanuts and general refreshments. Nearly all the applicants were residents of Paris, though citizens of this country. Since the appropriation by Congress of $150,000 for expenses, and the appointment of Mr. McCormick as Commissioner General, the representation of the United States in the Exposition is assuming a tangible form. We learn from Mr. McCormick that he will receive applications for space up to January 10th, after which apportionments will be made of all the space at his disposal to those whose applications are then on file. Machinery may be entered, both heavy and light, up to that date.

Only a few days ago the Commissioner General opened his office in Room 24, New York Post Office building, and over two hundred regular applications for space have already been received, while additions swell the number every day. All the space in the machinery galleries devoted to exhibits from the United States is about 80 by 120 feet, though a ground area of 262 by 185 feet is allotted to the United States, on which buildings for special exhibits can be erected as occasion requires. It must be observed that goods are to be arranged in a more compact manner than at the Centennial, there being less room allowed for elaborate showcases and repetition of articles in the same exhibit that are essentially alike. The three vessels designated by the Government (the Supply, the Constitution and the Wyoming) to transport goods for the Exposition to Havre will sail about the 1st and 15th of February, and the 15th of March repectively. We give herewith the names and addresses of a few of those who have decided to exhibit at Paris:

William Sellers & Co., Philadelphia, Machinery and Tools; Brown & Sharpe Manufacturing Co., Providence, R. I., machinery and tools; Taylor Manufacturing Co., Westminster, Md., four steam engines; Sample, McElroy & Co., Keokuk, Iowa, steam engines; B. S. Nichols, Burlington, Vt., steam engines; Baxter Engine Co., New York, steam engines; Snyder Brothers, New York, steam engines; A. & F. Brown, New York, hot air engine (weighing 1,400 lbs.); Welch & Lawson, New York, gas engines and gas machines; Cammeyer & Sayre, New York, hot air engines; Porter, Bell & Co., Pittsburgh, Pa., light locomotives; Bradley Manufacturing Co., Syracuse, New York, the Bradley cushioned hammer; J. A. Fay & Co., Cincinnati, Ohio, wood working machinery; H. Prentiss & Co., New York, taps and dies; George Parr, Buffalo, New York, engines and tools; Burleigh Rock Drill Co., Fitchburg, Massachusetts, rock drilling machines; Mohawk & Hudson Manufacturing Co., Waterford, New York, steam and water valves; J. M. Everhardt, Scranton, Pa., engineers' brass work; Charles D. Smith, New York, boiler furnace; Hagstoz & Thorpe, Philadelphia, parallel pliers: D. A. Green, New York, feed water heater; Anton Heim, New York, leather belting: P. Jewell & Sons, Hartford, Connecticut, leather belting; J. B. Hoyt & Co., New York, leather belting; Wm. L. Gregg, Philadelphia, brick machines; F. Meyers, New York, lathes for wood turning; Trump Bro's., Wilmington, Delaware, scroll saws; W. & B. Douglas, Middletown, Connecticut, pumps; Rumsey & Co., Seneca Falls, New York, pumps; The Goold's Manufacturing Co., Seneca Falls, New York, pumps; L. J. Knowles, Warren, Mass., and New York, steam pumps; Valney W. Mason & Co., Providence, R. I., friction clutches; E. B. Stimpson, New York, shoe machinery; The John Stephenson Co., New York, street cars and omnibuses; Ansonia Brass & Copper Co., New York, brass goods and clocks; Withington & Cooley Manufacturing Co., Jackson, Mich., garden and farming tools; American Machine Co., Philadelphia, fluting and wringing machines; Walton Brothers, New York, engineers' and naval supplies; Vanderveer & Holmes, New York, bakers' machinery; Providence Tool Co., Providence, R. I., breech loading fire-arms; Dr. J. Byrne, Brooklyn, New York, electric motor power.

The advantage of exhibiting American machinery at Paris Exposition is not to be overlooked by our manufacturers who desire to secure European trade. At a small expense to the exhibitor, the best mechanical inventions can be placed where, for six months, they will be viewed by hundreds of thousands, with that peculiar interest which only a gigantic exposition of the products of all nations can awaken. Machines that are not new or striking with us may there be looked upon as masterpieces of advanced inventive and constructive skill. Goods intended for the Exposition will be taken to Paris, and at its close returned without charge to the owners. Competent engineers may be engaged to attend machines during the whole six months, at a moderate expense for the number of such seeking engagements, each for several exhibits is already quite large. True, there are more that are incompetent and untrustworty looking for engagements, but the manufacturer can select aright with proper caution.

It is an interesting study to watch the reaction of popular ideas in a great nation after severe business depression has existed for a considerable length of time. In our own country a protective tariff has been in force since 1861, and so long as commercial affairs were bright and prosperous, about all the hostile opposition to that system arose from those directly interested in importing foreign goods to compete with home manufactures. Now, after four years of general shrinkage an unmistakeable reaction is apparent to a close observer, especially in New England and some parts of the West. It comes from a staid and quiet, though influential, element of community, and is not manifested in free trade conventions or rampant speeches. In England, where free trade has held uninterrupted sway for many years, the reaction is even more striking than with us, and crops out repeatedly in most industrial newspapers received from Great Britain. In Sheffield, Birmingham, and other large manufacturing centers, a protection party seems to be growing up, and we need not be surprised to hear within a few months that the English Government has been memorialized by manufacturers of iron and steel goods to levy strong protective duties on imports.

Singer, Nimick & Co. Pitsburgh, are running part of their steel mills double turn. They employ over four hundred men, and report orders coming in freely.

MANUFACTURES.

CONNECTICUT.

Perry Yarrington, formerly of the Norwich Pistol Co., will start a pistol factory in Hartford about January 1.

The Billings & Spencer Co., Hartford, are running their works full time, and find business unusually brisk. Sixty men are now employed, while seventy-five is the largest force they ever employed at the same time.

P. Jewell & Sons, Hartford, are running the leather belting factory steadily with a good supply of orders on hand. They state that they are doing more this year than in any other for ten years past. They will have a display at the Paris Exposition.

I. B. Davis, Hartford, has lately sent two large Berryman feed water heaters to the Otis Steel Works, Cleveland, Ohio; one to Cocheco Print Works, Dover, N. H.; one to Pacific Guano Co., Charleston, S. C.; one to a brewery in the same city; and one to the Philip & Best Brewing Co., Milwaukee.

PENNSYLVANIA.

The employes of the Lackawanna Iron Co., at Scranton, are put through a military drill once a week.

A number of iron workers and others in the First ward, Harrisburg, are preparing to emigrate to Texas.

The Empire Chain Works, Philadelphia, have been busy all season. Cable and small chain are the principal articles.

Joseph Heginbotham, Philadelphia, manufacturer of knitting machines, is doing a good business—better than formerly.

Lewis, Oliver & Phillips, Pittsburgh, are running full time employing about sixteen hundred hands. They report the rush of trade over, and are getting up stock for spring trade.

S. D. Hubbard & Co., manufacturers of the Eclipse steam pump, shipped to the oil fields of Peru, on Friday, Dec. 21, per order of Prentice & Angle, of New York, a blowing engine, boiler and tank fixtures.

An agent of Prentice & Co., who are now developing the oil fields in Peru, has been in Pittsburgh, purchasing machinery for an extensive refinery, which has been established some forty miles distant from the place where the oil has been found. The agent purchased a blowing engine, and is having a still manufactured at the works of D. W. C. Carroll & Co.

R. Munroe, of the West Point Boiler Works, Pittsburgh, is having about the usual amount of work for this season of the year. He is doing a good deal of work for the oil regions.

The Catasauqua Manufacturing Co. were yesterday working on iron designed for Russia, and the Union Foundry is making castings to be forwarded to Hayti and Brazil.—*Catasauqua Dispatch, Dec.* 22.

The Pennsylvania Railroad shops at Altoona employ 3,000 operatives, whose wages amount to about $1,500,000 a year.

Orders have been received at the machine shops of the Reading Railroad Company, at Reading, to build at once four six-wheeled pushing locomotives of the Minerva class. The boiler work for these new engines is now being placed in hand.

The Fairmount Machine Works, Philadelphia, are very busy. The products are looms and winding machinery, shafting, pulleys, and hangers, hoisting machines, lard and paraffine oil presses, of which large quantities are shipped South and to South America and Mexico.

The Philadelphia File Works—Alexander Krumbhaar—report a very gratifying improvement in business during the past few months. Their manufacture is of hand-cut files, made exclusively of black diamond American steel, which is considered better than the English product, actual tests having proved that files of American steel manufacture are capable of 33 per cent more service than the imported English files. Mr. Krumbhaar had a comprehensive display of his goods at the Centennial Exhibition, and finds a consequent increased demand at home and from Cuba.

MASSACHUSETTS.

J. A. Sawyer & Son, machinists, Worcester, have just completed and moved into a new brick shop.

The Arlington Tool Company expect soon to occupy the unused Douglass Manufacturing Company's works at Sunderland.

The East Wareham Iron Works have shipped this month up to the 12th, sixty tons of tack plate. The company pay roll last month was about $2,009.

The Ames Works, at Chicopee, after considerable bother in getting fairly going, are now turning out 500 blades a day on their Turkish sword contract, and in the course of three months expect to get up to 1,000 a day.

The Wason Manufacturing Company, of Springfield, have about 75 men at work on their recent order for 100 frieght-cars for the Panama Railroad, and more will be taken in when material arrives. The specifications call for the use of water-soaked lumber exclusively, as air-seasoned wood will not stand the climate, and considerable difficulty has been experienced in getting it as fast as wanted.

Nine hundred people are now employed at the Waltham Watch Factory, and this number has never been exceeded by more than twenty. The company are unusually pressed with orders in their case department, and engravers are in demand—engraving, finer and more of it, being now the style.

The Worcester Machine Screw Co. have lately fitted up their factory with the new Gifford's patent automatic screw machinery, and are now prepared to furnish set and cap screws, engine studs, and a great variety of special milled work at much lower prices than formerly. Their shop is 125x50 feet, besides outside buildings, and they are now negotiating for another room of the same size. They are manufacturing a class of upset machine screws which are selling as low as good material and first-class workmanship will allow.

The following is a recent summary of one week's business of the Exeter Machine Works, Boston: Claflin, Colburn & Co., Milford, Mass., making additions to their steam power, put in a 40 horse power Exeter sectional boiler; J. W. Sanborn, Kingston, N. H., purchased an Exeter boiler and engine for his factory; J. J. Foy, Portland, Me., placed an Exeter boiler and engine in his flour factory; T. W. Colburn, New Durham, N. H., put in a 15 horse power Exeter boiler; George Johnson & Co., Wilmot Flat, N. H., contracted with the Exeter Machine Works for a complete heating apparatus for his hosiery factory. E. Jones, Scytheville, N. H., purchased an Exeter engine, which he will put in his tannery next spring.

NEW YORK.

The Schenectady Locomotive Works have shut down for an indefinite time.

John Hartrick & Co., Gold street New York, is building a new style of vertical steam engine from 6 to 15 horse power, for stationary purposes.

Exports.

J. B. Hoyt & Co. recently sent in one batch $1,550 worth of leather belting to Liverpool.

The Stiles & Parker Press Co., Middletown, Conn., have lately sent presses to England and Germany.

P. Jewell & Sons, Hartford, are exporting leather belting to nearly every civilized country in the world.

E. Harrington & Son, Philadelphia, have sold several of the patent hoists to parties in South America.

Hoopes & Townsend, Philadelphia, have just filled orders for their goods from Sandwich Islands and Australia.

H. & F. Blandy, of Zanesville, shipped recently two portable engines of their manufacture, to Emperor Dom Pedro, Brazil.

Goodell & Waters, Philadelphia, have just shipped a heavy 6-rolled double-surfacer and matcher to South America, and a heavy endless bed planer and matcher to St. Johns, N. B.

Smith Bros., Brooklyn, N. Y., have sold sixteen steam boilers of their manufacture, this year, to sugar planters in Cuba. They range from 75 to 125 horse-power each. Four of them were for the largest sugar planter in Cuba.

E. Gould & Eberhardt, of Newark, lately shipped a large shaping machine to Hamburg, Germany. This firm have established quite a trade in South America and the West Indies. They are employing about forty hands in their works, and report business fair.

Discoveries.

S. E. Adamson, 3 Park Place, N. Y., has discovered a very simple and inexpensive process for embossing iron castings, which can be applied with equal efficiency to either wood or iron patterns. It is applicable to hollow-ware, stone plates and any kind of iron castings requiring fancy designs. The embossing is deep and well defined. The line of designs that can be used embraces about 50 styles, which can be obtained at 25 to 30 cents a yard in any large city. The cost is practically nothing more than time of preparing the patterns, which is very quicky done.

G. W. Francis, Middletown, Conn., has discovered a chemical substance to cover stove-pipes or any kind of sheet metal ware, with a beautiful black enamel that is impenetrable to the action of air, acids, creosote, or the salts of iron. It will also stand any ordinary amount of heat.

The Methods of Setting Steam Boilers in Brick-work.

THERON SKEEL, ENGINEER, 149 BROADWAY, N. Y.

The general principles which apply to the setting of steam boilers to obtain the most steam from the smallest quantity of coal are extremely simple, and are as follows:

I. The highest chimney.

II. The largest grate on which the coal will burn without going out.

III. The largest amount of heating surface.

IV. The smallest opening through the tubes or flues.

If a man starts out with these principles in view, he may obtain the best results with almost any arrangement of setting, but unfortunately he needs another thing, namely: *a large bank account.* The problem of obtaining equally good results with a smaller investment of money, is the problem which presents itself to the practical man.

If a builder has unlimited capital at his command, he can scarcely devise any arrangement of boiler setting by means of which he can evaporate more then 12 pounds of water for a pound of anthracite coal after the ashes and cinders are deducted, and when the feed water is fed in boiling hot (212°). On the other hand the poorest possible arrangement of setting, and the least amount of boiler surface ever used in practice, will almost always show an evaporation of at least 8 pounds of water evaporated by one pound of anthracite coal after the ashes and cinder are deducted and when the feed water is fed in boiling hot (212°). This difference, 50 per cent, is the greatest ever found in practice. Between these two limits boilers generally vary. Any man who has the most wasteful boilers may make them the most economical by reducing the amount of steam he draws from them, and by checking the draft by *closing the ash-pit doors*, provided no cold air leaks in through cracks in the brick-work.

Generally manufacturers do not have any more steam than they need. The cases where they have a *spare* boiler which is not used, being held in reserve in case one of those in use breaks down, are extremely rare; and indeed it is not desirable that there should be a spare boiler, for, if well built and properly cared for, the boilers are not more likely to break down than the other machinery in the mill. Also, if a manufacturer has more boilers than he needs, there can be more steam made than is necessary. In the course of a few years the manufacturer is sure to find that all the boilers are in use, and of course the *extra steam wasted.*

If the boilers are pressed to their utmost the engineer will take care to keep his safety valve tight, his engine in good order, and to reduce all waste of steam to the lowest possible limit. On the other hand, if he has a spare boiler it is much easier to start a fire under it than search for and repair the leaks. The coal burned under the extra boiler, of course, comes out of the profits of the business.

I believe it is the best policy for a manufacturer to have boilers capable of burning the least possible amount of coal he can get along with, *and no more.*

The amount of coal that may be burned depends upon the height of the chimney, the size of the grate, and the area of opening for the passage of gas and smoke through the tubes or flues. Having fixed these three elements the manufacturer may increase the length of the boilers and obtain any rate of economy he pleases up to about 12 pounds of water evaporated for each pound of anthracite coal burned after the ashes and cinders are deducted, and the feed water fed in boiling hot (212°).

The idea that a boiler is necessarily wasteful of coal because it is being forced to its utmost capacity is *erroneous.* A boiler of the proper proportions may be working to its best advantage under these circumstances. The points for a manufacturer to consider, then, are:

I. How much steam does he require.

II. How efficient a boiler is he willing to pay for.

The great difficulty is to fix the amount of steam necessary. The only two industries I know of in which the amount is fixed, are "tanning" and "grinding wheat." To tan a pound of leather and prepare it for market takes 20 pounds of steam.

To grind a pound of flour and prepare it for market takes one pound of steam.

Thus, if a manufacturer proposes to build a flour mill capable of turning out 1,000 bbls. of flour in 23 hours (allowing one hour out of the 24 for the mill to be at rest for repair, &c.) he knows that if all his machinery is of the best construction he will need

$$1000 + 200 \div 23 = 8{,}700$$

pounds of steam per hour.

If he proposes to build a tannery capable of turning out 50,000 hides of sole leather, weighing 40 pounds each, and to run 300 days in the year and 24 hours a day, he knows he must have boilers capable of furnishing

$$\frac{50{,}000 + 40 + 20}{300 + 24} = 5{,}550$$

pounds of steam each hour. If he is going to build anything else than a tannery or a flour mill, he will have to determine for himself how much steam he will need by seeing how many barrels of water are pumped into the boilers of some similar establishment each hour.

All estimates based on the so-called "Horse-power" of boilers are entirely erroneous. The horse-power of a boiler called "100 Horse-power boiler" may vary from 25 horse-power to 250 horse-power, depending upon the height of chimney, size of grate, kind of engine, &c.

In considering the maximum capacity of any proposed form of boiler, the following elements must be considered:

I. The kind of coal.
II. The temperature of the feed water.
III. The height of the chimney.
IV. The size of the grate.
V. The area of opening through the flues or tubes.
VI. The amount of heating surface.

In general the temperature of the atmosphere and the pressure of the steam do not affect the result to any considerable degree.

If the above six elements are given to a skilful engineer he can predict with great accuracy how much coal can be burned, and how much steam will be furnished by the boilers. It will be seen that the builder may vary any one of those six elements at his pleasure. The variation of any of them affects the result. The effect of the variation of these elements will be considered in order:

1. The kind of coal.

The kinds of coal in general use in the United States are

The semi-bituminous coal from Maryland.
The anthracite from Pennsylvania.
The bituminous from Pittsburgh.
The bituminous from Ohio.

When burned in the ordinary furnace these coals will furnish steam, per pound of coal, in the following proportion:

Semi-Bituminous,	110
Anthracite,	100
Pittsburgh,	90
Ohio,	75

The weights of these coals that may be burned on the same grate, with the same chimney will vary as follows:

Semi Bituminous,	120
Anthracite,	100
Pittsburgh,	120
Ohio,	200

It will be seen, then, that to furnish a given amount of steam with these various coals, there will need to be more grate surface for the anthracite than for any other. The proportional amount of grate surface that will be needed to furnish the same amount of steam will be as follows:

TABLE I. Relative amount of grate surface that will be necessary to burn coal enough to furnish the same quantity of steam with various kinds of coal:

Anthracite,	100
Pittsburgh,	90
Semi-Bituminous,	75
Ohio,	67

This table refers to the average coal of each kind found in practice. Throughout the following paper the coal spoken of will be anthracite coal. The grate must be made smaller for other coals in the proportion to the above figures.

II. *Temperature of feed water.*—The hotter the feed water the more steam the boiler will furnish in the same time.

The relative amounts of steam that will be furnished in the same time, and by the same quantity of coal, are given in the following table:

TABLE II. Relative amounts of steam that will be furnished in same time, or by same weights of coal with various temperatures of feed water.

Temperature of feed water.	Relative amount of steam.
212°	100
200°	98
180°	96
160°	94
140°	92
120°	90
100°	89
80°	87
60°	86
40°	83

Throughout the following paper the feed will be supposed to be at 212°. Whenever the feed is less than this, the amount of steam that will be furnished must be reduced in proportion to the above numbers.

TABLE III. Relative amount of coal that can be burned in the same time with chimneys of various heights.

Height of chimney in feet.	Relative amount of coal.
120	100
100	90
80	80
60	70
40	57
20	40

It will be seen that after a moderate height of chimney is reached, the effect of any increased height is very small.

Throughout this paper the chimney will be supposed to be 120 feet high. Whenever the height of chimney is less than this, the amount of coal that can be burned must be reduced in the proportion of the above numbers.

IV. In general the larger the grate the better, but there are certain things which limit its size in practice. Ashes and clinkers collect on the grate and have to be removed with a slice bar. When the grate becomes more than six feet deep it is very hard to clean the back end of it. The width of the grate is generally limited by the two brick walls on both sides of the boiler. The largest grate then that is generally obtainable in practice is six feet deep, and from 4 to 8 inches wider than the boiler. I do not think the grate should ever be made smaller than this under ordinary circumstances.

V. *Opening through the flues or tubes.*—This is one of the most important items in a boiler, and the one which is most generally neglected. With a given grate the opening through the flues or tubes regulates the amount of coal that can be burned, and therefore the amount of steam that can be formed. The opening should be as small as will burn the amount of coal required. The necessary area is given in the following table.

There is no use of making the opening through the tubes more than $\frac{1}{2}$ of the grate, for the gas will not fill the extra tubes, and they are *entirely useless.*

TABLE V. Pound of coal, that may be burned per hour on each square foot of grate, when the opening through the flues is the following proportion of the grate.

Ratio of opening through the flues to grate surface.	Pounds of coals that may be burned on each sq. ft. per hour.
$\frac{1}{40}$	6
$\frac{1}{30}$	8
$\frac{1}{20}$	11
$\frac{1}{15}$	14
$\frac{1}{10}$	17
$\frac{1}{7}$	20

VI. *Heating Surface.*—The amount of heating surface may be with good effect as much as the manufacturer feels able to pay for. When the opening through the tubes is fixed, the only way he can increase the heating surface is to increase the *length* of the tubes or flues. The longer the tubes or flues the better the result. The length of the flue or tubes must be proportional to its diameter; that is to say, a tube 6 inches in diameter must be twice as long as one 3 inches in diameter to produce the same steam from the same coal.

TABLE VI. Ratio of length to diameter of tube or flues in order to evaporate the following weight of water per pound of coal.

Ratio of length to diameter.	Pounds of water evaporated per pound of coal.
10	5.4
15	6.7
20	7.4
30	8.3
40	9.1
50	9.7
60	10.0

The foregoing tables give all the necessary information in regard to proportions of boilers.

Example. Suppose a manufacturer wishes boilers which will furnish 5,000 pounds of steam with 700 pounds of coal per hour, that his chimney is 60 feet high, and his feed water fed in at 150° (the usual temperature when a high pressure engine and heater are used.) From table II. we find that this 5,000 pounds steam at 150° is equivalent to $5{,}000 \div 93 = 5{,}370$, when feed is 212°, and that therefore he will have to evaporate

$$\frac{5370}{700} = 7\frac{7}{10}$$

pounds of water for each pound of coal.

From table VI. it appears that to get this evaporation the tubes must be 25 times as long as they are in diameter; that is to say, if they are 6 inches in diameter, they must be

$$25 + 6 = 150'' = 12\tfrac{1}{2} \text{ feet.}$$

If the maufacturer decides to have two boilers each 5 feet in diameter, the grates may be each 5 feet 8 inches bv 6 feet = 34 sq. feet, being 68 sq. feet for both *boilers.* The coal then must be burned at the rate of

$$\frac{700}{68} = 10\tfrac{1}{2}$$

pounds per sq. foot of grate per hour.

From table III. it appears that when the chimney is only 60 feet high, the consumption is only $\frac{7}{10}$ as much as when the chimney is 120. The opening through the tubes then must be sufficient to burn

$$\frac{10.5}{0.70} = 15$$

pounds per sq. foot of grate with a chimney 120 feet high.

From table V. it appears that to burn 15 pounds per square foot of grate requires an opening through the tubes of $\frac{1}{14}$ the grate, or in this case

$$\frac{68}{14} = 4.9 \text{ sq. ft.}$$

The proportions of the boilers would then be as follows:

Grate,	68 sq. ft.
Length,	$12\frac{1}{2}$ "
Opening through tubes,	4.9 "
Diameter of tubes,	6"

Two tubular boilers, each 5′ diameter with 15 six inch tubes each, would give this result.

Teeth of Gear Wheels.

The formation of teeth for gear wheels has engaged the attention of mechanics and scientific men for a great many years. Hook, Rankine, Willis, and others have devoted much time and thought to this subject, and the conclusion reached (with a single exception, as we remember) is that the sides of the teeth should be epicycloidal curves, and also that the curves should be so generated that all gears of the same pitch will run together.

To accomplish this, it has been demonstrated by theory and practice, that *all gears to be interchangeable must have their teeth formed by the same generating circle.* All this established, there have been many difficulties to overcome before the end sought for could be accomplished. Various methods have been resorted to to correctly shape the cutter for cutting the teeth of a gear, such as generating curves on thin metal, then working to the lines by filling, and then fitting the cutter to the templets thus made; but slight errors in each operation give anything but correctly-shaped cutters, and the mechanic, though having clear ideas as to the end sought, is baffled by the inability of skilled labor to avoid slight errors in the construction of cutters and other shaping tools. Prof. Willis recognized the difficulties and originated "the Odontograph" by which the epicycloidal curves are approximated by arcs of circles, but it only approximates and has

not satisfied the desires of our best mechanics. For a number of years, the Pratt & Whitney Company of Hartford, Conn., used the old methods of fitting to templets, recognizing the fact, that, though their gearing was good, yet it was not satisfactory, and not in keeping with the excellence and accuracy of their machinery.

Much labor and study has been given to the subject, and the result is the invention and perfection of two machines, lately shown to us, and which prompted this article. The first of these machines is for forming the cutters from formers of much larger pitch than teeth in general use, and is the invention of Mr. F. A. Pratt, the president of the company, to whose perseverance and continued study is due much of the perfection attained in the formation of gear teeth. It is not possible in this article to explain fully this machine. It is a pantagraph, delineating the exact shape of former and reducing to any smaller pitch. For a number of years the formers for this machine were made by hand, and although there were not as many opportunities for error as by the old methods, yet it did not accomplish the perfection wished for in consequence of imperfections in hand-made formers. Mr. Ambrose Swazey, superintendent of the gear-cutting department, finally invented the "Epicycloidal Milling Machine," a necessary concomitant for the "Pantagraph Machine."

With this machine, they are able to mill with accuracy a perfect epicycloid. The number of cutters, to cut from a pinion of (12) twelve teeth to a rack, is (24) twenty-four for each pitch. The different number of teeth each cutter is adapted to cut has been carefully estimated. No handwork is used in shaping the cutters, and they are not only perfect in shape, but can be produced for a fraction of the cost of hand-made ones.—*Boston Bulletin.*

Gooseneck Drills.

These drills are of beautiful design, made from entirely new and extra heavy patterns, and embrace in their general construction the most practical points for universal and miscellaneous use. The columns are heavy and well braced, are fitted with long bearings into large base-plates, which give ample support to the upper portion of the machine.

These base-plates are planed on their upper and lower surfaces and are provided with T slots, also plug and bolt holes. They serve as levelling plates and have bearings for guiding boring bars, etc. They have adjustable circular drilling tables (with plug and bolt holes), which admit of being horizontally revolved, and are also movable around the axis of the column which makes the tables perfectly adjustable to any desired point.

The drill spindles are made from hammered cast steel, are unusually large and have both hand and power variable feeds. The latter being operated by friction, its action is quick and without shock. Its arrangement, also, enables the operator to vary the feed instantaneously without change of belt. Spindles are also provided with quick return motion and lever feeds, which are very effectual, and so constructed as to be available at any point of the entire traverse of the drilling spindles. The lever feed, besides being convenient for drilling holes rapidly up to $\frac{3}{4}$ inch diameter, is equally useful for small slotting and splining.

Back gears are conveniently arranged within working reach and quickly operated. Bevel gears for driving the spindles are powered to about 3 to 1, and are incased to prevent the throwing of oil, etc., upon the operator or the article worked.

Driving cones have four changes of speed, and are placed a goodly distance apart, thereby, giving good belting contact.

Outside bearings are of improved construction, have a wide range for wearage, and are susceptible of delicate adjustment. They tighten to the center and wear to a round bearing. The adjustable heads have an extended traverse which adds largely to the convenience and range of the machines.

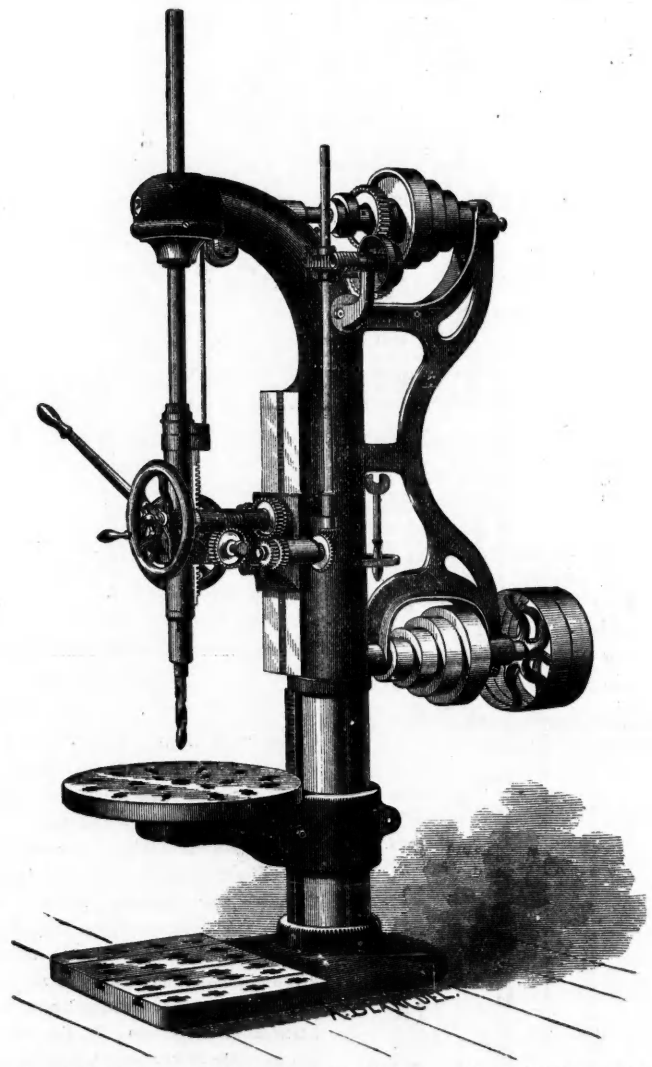
The accompanying cut represents the

GOOSENECK DRILL (NO. 2).

It has adjustable table 25 inches in diameter, with a vertical traverse of $16\frac{1}{2}$ inches, and will receive work 46 inches in height on the base-plate, and 36 inches on the drilling table; will also admit articles 28 inches in diameter between center of spindle and face of column. The drilling head is arranged to be set at any desired height on the ways, and has a traverse of 20 inches. Spindle is $1\frac{3}{4}$ inches diameter, and has a run $12\frac{1}{2}$ inches without change. The driving pulleys are 14 inches diameter, $3\frac{1}{4}$ inches face, and should make 160 revolutions per minute. The weight of the machine is 2,200 pounds. Larger sizes (Nos. 3 and 5) are manufactured, and are adapted for work of greater dimensions. They are manufactured by the Putnam Machine Co., 115 Liberty Street, N. Y., and Fitchburg, Massachusetts.

Machines and Tools at the Philadelphia Exhibition.

Dr. Anderson's elaborate report on machine tools is pervaded throughout by a perfectly enthusiastic admiration of the American exhibits. None of the countries of Europe were strongly represented, in fact the reporter thought the department "could hardly be regarded as an international competition."



From Gebbie & Barrie's "Masterpieces of the U. S. International Exhibition, 1876."

GOOSENECK DRILL.

Though Dr. Anderson will not allow that we are falling behind, he yet admits that our exhibits at Vienna gave foreigners the impression that we were being passed by the Americans, and that the show we made at Philadelphia will certainly strengthen this impression.

A special feature in this section was that all machine tools were tested for accuracy if their owners wished it. Nearly all the Americans agreed to this, but none of the foreign exhibitors, except one Canadian and one French firm. Some machines were also tested for rapidity of work; for example, a locomotive cylinder was bored out, the ends of the bores recessed, and the flanges turned and faced in three hours and a half. On the whole, the results of the tests were such as to take the judges by surprise. The saws were not tested, time not sufficing for the exhaustive series of trials which alone, it was thought, would be of any real value.

Another special feature of the Machinery Hall consisted of the great pair of Corliss engines that drove the machinery, and the arrangement of shafting and gearing by which the power was transmitted. All this gear worked with perfect smoothness and quiet. The spur teeth were all cut by a machine exhibited near the engine, and were so scientifically shaped as to work almost without noise or tremor.

The English display was, for this country, poor, and it was only by exhibits sent by Canada that the credit of the empire was saved. Both the metal and the wood working machines shown by the colony showed considerable originality, especially, as might be expected, the latter class. The small cost of material induced a tendency to neglect economy for the sake of speed, and the wood-cutting machinery was, therefore, of a very massive and powerful character. The first English exhibit noticed by Dr. Anderson was that of Messrs. Massey, who showed a number of steam hammers, varying from the smallest size up to five tons.

The German exhibit was neither extensive nor good. The machines that attracted notice were one for cutting small bevel wheels, and a special arrangement for grinding metal surfaces with a fast running emery wheel. Some tools for machine watch-making were also highly commented upon.

In France, the machines sent by Arbey, of Paris, are noticed by Dr. Anderson, almost to the exclusion of any others. His planing machines, with their steel cutters wound vertically on cylinders (like the knives of lawn-mowing machines), were unique. Another machine, for shaping the edges of cask-staves, so that they may fit water-tight, was considered the best of the class, though there were numerous exhibits of cask-making machinery in the United States section.

Belgium showed the actual apparatus by which Mount Cenis was tunnelled. Sweden had an exhibition of sawing machinery, but it was quite overpowered by the magnificent American display of similar machinery. Russia showed great improvement on Vienna, and seemed to have acquired some of the practical knowledge which was wanting to combine with her theoretical knowledge. A noticeable feature in the Russian section was an exhibition of models and machines made by the students of the technological schools of Moscow and St. Petersburg. This collection included lathes, planing machines, parts of steam engines, valves, governors, &c. Brazil is the only other country mentioned.

It is to the exhibits of the United States that Dr. Anderson devotes the larger portion of his report, though, as he says, that can only note the more salient points in the space at his disposal. He begins by reference to "probably the most exquisite set of machine tools ever made," those employed for machine watch-making by the American Watch Company, of Massachusetts. Several other sets of tools are shown, one for making gun-stocks, another for cutting the wheel gearing for the Machinery Hall, are also referred to. The use of special tools for special purposes was specially remarked by the reporter, and he gives as an instance, a lathe specially constructed for making water injectors for steam boilers. Though no furnaces were allowed to be lighted in the Exhibition, there was a fine show of apparatus for smiths' work, in some of which there were remarkable instances of the way in which perfect mechanism can replace skilled labor. Where articles have to be repeated, as in making the interchangeable parts of railway bridges, the bars of iron are brought forward on trucks, the ends of the bar are heated in a furnace, and then put into a set of dies worked by hydraulic pressure.

In drilling machines, the Americans have almost a specialty. The Morse twist drill is of course an American invention, and this is only one of many. Their latest improvement seems to be the use of a spiral tube for transmitting power to drills round corners and in positions where the ordinary apparatus cannot act. On a small scale this arrangement has been employed for some years by dentists, but it is now employed for heavy work. A spiral is also used to stiffen a tube which has to be bent. It is stiff enough to prevent the tube collapsing, and can be readily withdrawn by winding it in its own direction, so as to tighten the coils and reduce its diameter. The use of the emery wheel is, as might be expected, noticed by Dr. Anderson. This is another practical improvement we owe to America. The wheel is there used for much work which is generally effected by planing and shaping machines. The required results are produced "not by the old system of hap-hazard grinding, but by well-defined movement, rendered as certain in its action as the ordinary tools employed in the various branches of engineering." For trimming rough castings, too, Dr. Anderson saw these wheels largely used, and he was much struck by the way in which they did their work.

In one respect "a new departure' has been taken by the Americans in punching metal, and in shearing and detrusive operations generally. This was principally illustrated by the specimens shown by the firm of Hoopes & Townsend, of Philadelphia, and described by Dr. Anderson in the following words:

"The articles shown consisted chiefly of nuts and other similar perforated specimens; all were of remarkable beauty, and were given away in profusion. These nuts had two peculiarities, they were of inordinate depth, and showed clearly that they had been punched cold. Visitors, however, did not hail this new fact in practical science; they said it was an impossibility for a $\frac{3}{8}$ inch punch, however good the quality of steel, to penetrate through $1\frac{3}{4}$ inches of cold iron; that whatever might be the explanation, a punch of that diameter could not do it without being broken or crippled.

"In time the secret leaked out, for it was no imposture. The firm, in punching, take advantage of the fluid property of solid cold iron or steel by introducing the element of time into the performance of the operation, giving to the punch only such a load of pressure as it can comfortably sustain, then giving up the reins to nature, when the instrument penetrates at a rate dependent on and in proportion to the fluidity of the mass."

In conclusion, Dr. Anderson sounds a note of warning to our own manufacturers:

"Hitherto we have been justly proud of the perfection of the system and organization in our cotton manufactories. What Arkwright did for the cotton mill the Americans have introduced into numerous other branches, watch-making, for example, with equal advantage. In past times England has been the nursery-ground of the manufacturing system; her factories have been visited, and her system of cotton and other textile manufactures have been copied by all nations; but the time seems to have arrived when we shall have to visit America in the same way, and for the same purpose, in regard to the production of other things, and there is no time to be lost if we mean to hold our own in the hardware trade of the world, at least in regard to the class of things that are required in large number or quantity."—*Journal of the Society of Arts.*

Machinists' Hand Taps.

V and Franklin Institute Shape of Thread.

3 TAPS TO SET—TAPER, PLUG AND BOTTOMING.

Diameter.	Price Each.	Diameter.	Price Each.
1-4	$0 45	15-16	$1 80
5-16	50	1	2 00
3-8	55	1 1-8	2 25
7-16	60	1 1-4	2 60
1-2	70	1 3-8	3 00
9-16	80	1 1-2	3 50
5-8	90	1 5-8	4 20
11-16	1 05	1 3-4	5 00
3-4	1 20	1 7-8	5 80
13-16	1 40	2	6 70
7-8	1 60		

Machine or Nut Taps.

V and Franklin Institute Shape of Thread.

LONG SHANK.

Diameter.	Price Each.	Diameter.	Price Each.
1-4	$0 60	15-16	$2 40
5-16	70	1	2 80
3-8	80	1 1-8	3 20
7-16	90	1 1-4	3 70
1-2	1 00	1 3-8	4 20
9-16	1 15	1 1-2	4 70
5-8	1 30	1 5-8	5 30
11-16	1 45	1 3-4	6 00
3-4	1 60	1 7-8	6 80
13-16	1 80	2	7 70
7-8	2 10		

Taps for Machine Screws.

Wire Guage, Size.	Price Each.	Price per Doz.
No. 4	35c.	$4 00
6	35c.	4 00
8	35c.	4 00
10	35c.	4 00
12	35c.	4 00
14	38c.	4 40
16	38c.	4 40
18	38c.	4 40
20	45c.	5 30
24	45c.	5 30

Solid Reamers.

Diameter of Reamer.	Price Each.	Diameter of Reamer.	Price Each.
1-4	$1 40	15-16	$3 80
5-16	1 55	1	4 10
3-8	1 70	1 1-16	4 50
7-16	1 85	1-8	4 90
1-2	2 00	1 3-16	5 30
9-16	2 20	1 1-4	5 70
5-8	2 40	1 5-16	6 10
11-16	2 60	1 3-8	6 50
3-4	2 90	1 7-16	7 00
13-16	3 20	1 1-2	7 50
7-8	3 50		

Grant's Patent Adjustable Tap-

ıerch

Drop Forged from Wrought Iron.

No. 1, Fits 3-16 to 1-2 inch Taps	Price,	$4 50
No. 2, Fits 5-16 to 3-4 iuch Taps	Price,	6 00
No. 3, Fiis 1-2 to 1 inch Taps	Price,	7 50
No. 4, Fits 3-4 to 11-2 inch Taps	Price,	00

Prentiss' Screw Plates and Dies

Drop Forged-

No. 1, with 5 pair Dies, 3-16, ¼, 5-16, ⅜, 7-16 in. diameter,	$7 00
No. 2, with 5 pair Dies, ½, 9-16, ⅝, 11.16, ¾ in. diameter,	10 00
No. 3, with 5 pair Dies, 13-16, ⅞, 15-16, 1, 1⅛ in. diameter,	15 00
No. 1 Plate will take Dies from 3–16 to ⅜ inclusive.	
No. 2 " " ⅜ to ⅞ "	
No. 3 " " ¾ to 1¼ "	
Single Dies, No,	$1 00
" No. 2,	1 25
" No. 3,	2 00

Morse Screw Plates.

SIZE A, with 3 pair Dies	$5.00
" B, " 4 "	8.00
" C, " 4 "	10.00
" D, " 4 "	13.00
SINGLE DIES, SIZE A	$1.00
" " " B	1.25
" " " C	1.75
" " " D	2.00

Clamp, Die, and Common Lathe Dogs.

Forged from Bar Steel and Hardened.

CLAMP DOG.

No, 1, 1¾ inch between Screws	$1 50
No. 2, 2¼ " "	2 00
No. 3, 2¾ " "	2 50
Price per Set of Three	5 50

DIE DOG.

1¼ inch between the sides	3 00
Extra Dies, 50 cents per pair	

COMMON DOG.

¾ inch,	0 50
⅞ "	0 60
¾ "	0 70
1 "	0 80
2¼ "	0 95
2½ "	1 10
3¾ "	1 25
3 "	1 40
4½ "	1 60
1 "	1 80
1⅝ "	2 00
1 "	2 30

Packer Ratchets.

No. 1, 10 inch handles,	$10 50
No. 2, 12 " "	13 50
No. 3, 15 " "	16 00
No. 4, 17 " "	19 00
No. 5, 20 " "	23 00

Boiler Ratchets.

No. 1, 10 inch handles,	$ 9 00
No. 2, 12 inch handles,	10 50

Auger Ratchets.

No. 1,	$7 00	Sockets,	$3 00
No. 2,	8 00	Screw,	3 00

Machine Makers Screw Drivers.

Drop Forged From Best Cast Steel.

ROSEWOOD HANDLES.

No. 1, ⅛ by 4 inch, per dozen,	$4 00
No. 2, ¼ by 4 inch, "	4 00
No. 3, 5-16 by 4 inch "	4 50
No. 4, ⅜ by 4 inch, "	5 50
No. 6, ½ by 6 inch, "	6 00

Iron Wire.

Nos.	0000 to 6	7 to 9	10 & 11	12	
Cents	9	10	11	11½	₱ lb.
Nos.	13 & 14	15 & 16	17	18	
Cents	12½	14	15	16	₱ lb.

BRIGHT MARKET WIRE..57½ ₱ct. dis. from above list,
" CHARCOAL " ..30 " " "

Cast Steel Wire.

Nos.	⅛ in. to 6	7 to 9	10 & 11	12	13	14	
Cents	23	24	25	26	28	30	₱ lb.
Nos.	15	16	17	18	19	20	
Cents	32	33	34	36	38	40	₱ lb.

25 per cent. discount.

Machinery Wire (soft). Machinery Spring Wire (elastic).

Nos.	00000 to 9	10 & 11	12 & 14	
Cents	15	16	17	₱ lb.
Nos.	15 & 16	17	18	
Cents	18	19	20	

10 per cent. off.

Grant's Improved Die-Stock and Die.

No. 0 Die-stock for jewelers, model makers, and machinists, with 6 taps and dies, cutting threads 3-32 to 1-4 inch sizes, with a handle for holding taps. Complete in box..... $7 50@8 00

No. 1, with 5 taps and dies for cutting rough nuts and iron of the following sizes and number of threads: ¼, 20; 5-16, 18; ⅜, 16; 7-16, 14; ½, 13. Complete in box..... $16 00

No. 2, with 6 taps and dies; sizes and threads as follows: 5-16, 18; ⅜, 16; 7-16, 14; ½, 13; ⅝, 11; ¾, 10. Complete in box..... 25 00

No. 3, with 5 taps and dies; sizes and threads as follows: ½, 13; ⅝, 11; ¾, 10; ⅞, 9; 1 inch, 8. Complete in box..... 32 00

No. 4, with 6 taps and dies; sizes and threads as follows. ⅞, 9; 1 inch, 8; 1⅛, 7; 1¼, 7; 1⅜, 6; 1½, 6. Complete in box..... 55 00

Taper Shank Twist Drills.

Diameter.	Price each.	Diameter.	Price each.
1-4	$ 65	1 5-32	$ 4 40
9-32	70	1 3-16	4 60
5-16	75	1 7-32	4 80
11-32	80	1 1-4	5 00
3-8	85	1 9-32	5 20
13-32	90	1 5-16	5 40
7-16	95	1 11-32	5 60
15-32	1 00	1 1-38	5 80
1-2	1 10	1 13-32	6 00
17-32	1 20	1 7-16	6 25
9-16	1 30	1 15-32	6 50
19-32	1 40	1 1-2	6 75
5-8	1 50	1 17-32	7 75
21-32	1 65	1 9-16	8 00
11-16	1 80	1 19-32	8 25
23-32	1 95	1 5-8	8 50
3-4	2 10	1 21-32	8 75
25-32	2 55	1 11-16	9 00
13-16	2 40	1 23-32	9 25
27-32	2 55	1 3-4	9 50
7-8	2 70	1 25-32	9 75
29-32	2 85	1 13-16	10 00
15-16	3 00	1 27-32	10 25
31-32	3 20	1 7-8	10 50
1	3 40	1 29-32	10 70
1 1-32	3 60	1 15-16	10 80
1 1-16	3 80	1 31-32	10 90
1 3-32	4 00	2	11 00
1 1-8	4 20		

Best Oak-Tanned Leather Belting.

Inches.	Per Foot.	Inches.	Per Foot.
1	$0 09	13	$1 53
1¼	12	14	1 65
1½	15	15	1 80
1¾	18	16	1 94
2	21	17	2 10
2¼	24	18	2 26
2½	27	19	2 42
2¾	30	20	2 58
3	33	21	2 74
3½	39	22	2 90
4	45	23	3 06
4½	51	24	3 22
5	57	26	3 56
5½	63	28	3 90
6	69	30	4 22
7	81	32	4 54
8	93	44	4 86
8	1 05	36	5 18
10	1 17	40	5 82
11	1 29	44	6 46
12	1 41	48	7 10

ROUND BELTS.

	Solid.	Twist.
1-8 Inch	.05	.05
3-16 "	.07	.09
1-4 "	.10	.12
5-16 "	.14	.16
3-8 "	.18	.20
1-2 "		.25
5-8 "		.30
3-4 "		.38
1 "		.53

Double Belts, twice the Price of Single. Intermediate Widths at Proportionate Prices. Extra heavy Belts Extra Prices.

Rubber Belting.

	3 Ply	4 Ply		3 Ply	4 Ply
2 inch,	$0 17	$0 21	12 inch.	$1 08	$1 30
3 "	26	31	13 "	1 18	1 42
4 "	34	25	14 "	1 28	1 54
5 "	43	52	15 "	1 38	1 66
6 "	52	62	16 "	1 50	1 78
7 "	60	73	18 "	1 70	2 02
8 "	70	84	20 "	1 90	2 26
9 "	80	95	22 "	2 12	2 52
10 "	90	1 07	24 "	2 36	2 80
11 "	1 00	1 18			

LIPSEY ADJUSTABLE STEEL WRENCH.

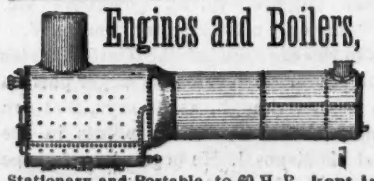
"RELIABLE"

STRONGEST AND BEST
MANF'D AT 91 WASHINGTON ST. N.Y.

By Roper Coloric Engine Company.

Engines and Boilers,

SPECIAL PRICES ON BOILERS TO Engine Builders.



Stationary and Portable, to 60 H. P., kept in Stock; also, Circular Saw Mills and Power Hammers
ERIE CITY IRON WORKS, Erie, Pa.

Tap Drills.

Diam. of Tap.	No. Threads to Inch.			Drill for V Thread.			Drill for U.S.S. Thread.	Drill for Whitworth Thread.
1/4	16	18	20	5/32	5/32	11/64	3/16	3/16
9/32	16	18	20	3/16	13/64	13/64		
5/16	16	18		17/64	15/64		1/4	15/64
11/32	16	18		1/4	17/64		9/32	9/32
3/8	14	16	18	9/32	9/32		11/32	11/32
13/32	14	16		19/64	21/64		3/8	3/8
7/16	14	16		21/64	11/32		13/32	
15/32	14	16		23/64	3/8		7/16	
1/2	12	13	14	25/64	13/32		1/2	1/2
17/32	12	13	14	27/64	7/16		17/32	
9/16	12	14		29/64	15/32		9/16	
19/32	12	14		31/64	1/2		19/32	
5/8	10	11	12	17/32	17/32		5/8	5/8
21/32	10	11	12	35/64	9/16		21/32	
11/16	11	12		37/64	19/32		11/16	
23/32	11	12		39/64	5/8		23/32	23/32
3/4	10	11	12	41/64	21/32		3/4	
25/32	10	11	12	43/64	11/16		25/32	
13/16	10			45/64	23/32		13/16	
27/32	10			47/64	3/4		27/32	27/32
7/8	9	10		49/64			7/8	
29/32	9	10		51/64	13/16		29/32	
15/16	9			53/64	27/32		15/16	
31/32	9			55/64	7/8		31/32	
1	8			57/64	29/32		1	1
1 1/32	8			59/64	15/16		1 1/32	1 1/32
1 1/16	8			61/64	31/32		1 1/16	1 1/16
1 3/32	8			63/64	1		1 3/32	
1 1/8	7	8		1 1/32	1 1/32		1 1/8	1 1/8
1 5/32	7	8		1 1/16	1 1/16		1 5/32	1 5/32
1 3/16	7	8		1 3/32	1 3/32		1 3/16	
1 7/32	7	8		1 1/8	1 1/8		1 7/32	
1 1/4	7			1 5/32	1 5/32		1 1/4	1 1/4
1 9/32	7			1 3/16	1 3/16		1 9/32	
1 5/16	7			1 7/32	1 7/32		1 5/16	
1 11/32	7			1 1/4	1 1/4		1 11/32	
1 3/8	6			1 9/32	1 9/32		1 3/8	1 3/8
1 13/32	6			1 5/16	1 5/16		1 13/32	
1 7/16	6			1 11/32	1 11/32		1 7/16	
1 15/32	6			1 3/8	1 3/8		1 15/32	
1 1/2	6			1 13/32	1 13/32		1 1/2	1 1/2
1 17/32	6			1 7/16	1 7/16		1 17/32	
1 9/16	6			1 15/32	1 15/32		1 9/16	
1 19/32	6			1 1/2	1 1/2		1 19/32	
1 5/8	5	5 1/2		1 9/32	1 5/16		1 3/8	1 23/64
1 21/32	5	5 1/2		1 5/16	1 11/32		1 13/32	
1 11/16	5	5 1/2		1 11/32	1 3/8		1 15/32	
1 23/32	5	5 1/2		1 3/8	1 13/32		1 17/32	
1 3/4	5			1 13/32			1 1/2	1 1/2
1 25/32	5			1 7/16			1 19/32	
1 13/16	5			1 15/32			1 5/8	
1 27/32	5			1 1/2			1 21/32	
1 7/8	4 1/2	5		1 17/32	1 17/32		1 5/8	1 37/64
1 29/32	4 1/2	5		1 9/16	1 9/16		1 23/32	
1 15/16	4 1/2	5		1 19/32	1 19/32		1 11/16	
1 31/32	4 1/2	5		1 5/8	1 5/8		1 25/32	
2	4 1/2			1 21/32			1 23/32	1 45/64

Iron Market.

NEW YORK, Dec. 28, 1877.

PIG IRON.—The year closes with a lethargy in the iron market, and but little hope of any decided change for the better for weeks to come. While the amount consumed is greater and the outlook better than it was one year ago, the greater part or the blast furnaces are idle, and many of those running steadily scarcely pay expenses. Prices remain irregular, depending upon brand, quantity, time of payment, and occasionally the financial necessities of the seller. The best indication we have to note is that average prices do not tend downward, and that the consumption does not decrease. In the month of December large blocks of iron have usually been sold at a concession from figures previously ruling. So far as we can learn this is not the case this year with perhaps one or two exceptions on North River Iron. Stocks of Pig Iron are not as burdensome as they were a year ago, though ample for prospective requirements Fancy brands are held at from one to two dollars a ton above the average, and as most of such extra iron is sold to regular customers who use it to a limited extent for particular purposes the general effect upon the market is trifling. Lehigh brands sell about the same as they have for many weeks past, and some North River at $17 for No. 1. We hear of late sales as follows: 200 tons No. 2 (Plain) Sterling $16.60, 250 tons Sterling Mottled and White $15.50, 50 tons No. 2 Sterling $17.25, 100 tons No. 1 Fulmer $20, 300 tons No. 1 Millerstown, part at $20 and part at $21, 100 tons No. 2 X Millerstown, $19; 100 tons No. 1 Coleraine, $19; 100 tons No. 2 Coleraine, $18. The Thomas Iron Co. is still practically out of the market, having made sales for delivery some months ahead. There are many rumors of large sales, but we can not trace any of them to a reliable source. The prevailing opinion of men who have been in the trade for many years seems to be that pig iron has reached "rock bottom' figures, and though there are no signs of au early advance any general decline is thought to be almost impossible, We quote average prices—No. 1, $18 to $19, and No. 2, $17 to $18. Scotch Pig is quiet and sells in small lots, at $26 for Coltness, $24 fer Eglinton, and $24.50 for Glengarnock.

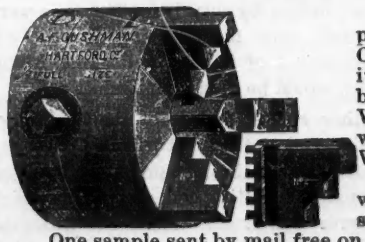
MANUFACTURED IRON trade is quiet, as it usually is at the close of the year, though the aggregate demand is larger than it was one year ago. We learn that some mills that were cutting prices below cost of production and sending out poor iron, are now out of the way to the great relief of the trade. Bar iron from store in small lots, still sells at the same regular prices as before the advance in freights from the west through merchants complain that there is no money in the trade. The elevated railroads in this city require about 30,0c0 tons of iron which gives three or four mills active employment. We quote refined bar two cents per pound, and common one and eight-tenth cents with considerable firmness, even in large lots.

RAILS.—The recent sale of 40,000 tons of steel rails to the Penn. Railroad and 10,000 tons to Western roads make about the only items of importance worth mentioning since our last. The price on those lots is understood to be $40 a ton delivered. The steel rail mills are very busy, and there is likely to be more demand after January 1. Iron rails are about neglected. Old T rails sell at $18 to $18.50 delivered, but are in light demand.

WROUGHT SCRAP.—For select No. 1 $23 is the highest figure we can quote; ordinary wrought scrap can be had at $22, or even less.

STEEL.—The demand is slow for all grades, orders being usnally small. Prices have undergone no change, nor are they likely to do so for some time to ceme.

THE AMATEUR CHUCK.



Especially designed for Foot Lathes and for all purposes where a Chuck is used; and, as a Drill Chuck for mechinists' use, it has no superior in quality, capacity or price. Is made to attach to the lathe by taper plug, face plate, or to screw on to the spindle. Will hold pieces 2½ in. diameter with No. 1 Jaws; and with No. 2 Jaws, will hold drills from 1-16 to ⅝ in. Warranted satisfactory.

Price, including Key and Screws for face plate, with either No. 1 or No. 2 Jaws, $5.50. With two sets of Jaws, $6.50.

One sample sent by mail free on receipt of price. Price to dealers furnished on application. Address,

A. F. CUSHMAN,
HARTFORD, CONN.

Address P.-O. Box 2187. # PIERSON & CO., Office, 24 Broadway, N. Y.

Established 1790.

IMPORTERS AND DEALERS IN IRON AND STEEL OF EVERY DESCRIPTION,

Warehouse, 24 and 26 Broadway and 77 and 79 New Street,

New York City, December 28, 1877.

TERMS NET CASH IN 30 DAYS. **PRICES SUBJECT TO MARKET CHANGES WITHOUT NOTICE.**

COMMON IRON.

	Price per lb.
1 × 3/8 to 6 × 1 Flat	1 8/10
1 1/4 to 6 × 1/4 and 5/16 Flat, / 1 and 1 1/8 × 1/4 and 5/16 Flat,	1 9/10
3/4 and 2 Round and Square,	1 8/10
5/8 and 11/16 " "	1 9/10
1/2 and 9/16 " "	2

REFINED IRON.

1 × 3/8 to 6 × 1 Flat,	2
1 to 6 × 1/4 and 5/16 Flat,	2 2/10
3/4 to 2 Round and Square,	2
2 1/8 to 2 7/8 " "	2 2/10
3 to 3 1/2 " "	2 4/10
3 5/8 to 4 "	2 7/10
4 1/8 to 4 1/2 "	3
4 5/8 to 5 "	3 3/10

RODS, ROUND AND SQUARE.

2 1/10	2 2/10	2 6/10	2 8/10	2 9/10	3 1/10	4 2/10
5/8 & 11/16	1/2 & 9/16	7/16	3/8	5/16	1/4	3/16

Ovals, Half Ovals & Half Rounds.

2 6/10	2 8/10	3	3 5/10	3 7/10
3/4 to 2	5/8 & 11/16	1/2 & 9/16	7/16	3/8

BAND. 1 to 6 × 3/16 to No. 12 - 2 4/10

HOOP.

5 8/10	4 4/10	3 6/10	3 4/10	3 1/10	2 9/10	2 7/10
1/2	5/8	3/4	7/8	1	1 1/8	1 1/4 & up'ds

HORSE SHOE.

3/4 × 3/8 to 1 1/8 × 5/8 - - 3 3/10

SCROLL.

4 8/10	4 8/10	4 3/10	3 8/10	3 6/10	3 4/10
1/2 × 16	14	12	10	3/16	1/4 & 5/16
4 2/10	3 8/10	3 5/10	3 3/10	3 1/10	2 9/10
5/8 × 16	14	12	10	3/16	1/4 & 5/16
3 4/10	3 2/10	3	2 9/10	2 8/10	2 7/10
3/4 × 16	14	12	10	3/16	1/4 & 5/16
3 2/10	3 1/10	2 9/10	2 8/10	2 7/10	2 6/10
7/8 × 16	14	12	10	3/16	1/4 & 5/16

	c.
Norway Bar Iron,	5
" Shapes,	6
Nail Rods, P. & Co., 6c., or U. B.	6 1/2
Angle Iron,	2 1/2
Tee Iron,	3
Sheet Iron Common,	2 9/10
Boiler Plate,	3 @ 3 1/2
Best Flange,	4 1/2 @ 5

EXTRA REFINED IRON.

Equal to H. B. & S. B. B. H. BAG. NALL'S or L. W.

Ordinary Sizes.

Round and Square. / Flats.	Price per lb.
3/4 to 2 in.	2 5/10 c.
1 × 3/8 to 6 × 1,	

Extras same as Refined.

ULSTER BEST IRON.

PIERSON & CO., keep in Stock a full assortment of this well known extra brand.

Ordinary Sizes.

	Price per lb.
3/4 to 2 Round and Square, / 1 1/4 × 3/8 to 4 1/2 × 1,	3 5/10 c.

Extras on Rounds and Squares.

1/4	1 3/10	5/8 and 11/16	2/10
5/16	1 1/10	2 1/8 to 2 3/8	2/10
3/8	1/10	2 1/2 to 3	1/10
7/16	6/10	3 1/2 to 3 1/2	6/10
1/2 and 9/16	4/10	3 3/4 to 4	8/10

Extras on Flats.

1 3/10	1 1/10	8/10
5/8 × 1/8 and 3/16	1/4 and 5/16	3/8 to 1/2
1 1/10	8/10	6/10
3/4 × 1/8 and 3/16	1/4 and 5/16	3/8 to 5/8
8/10	6/10	4/10
7/8 × 1/8 and 3/16	1/4 and 5/16	3/8 to 3/4
4/10	3/10	2/10
1 × 1/8 and 3/16	1/4 and 5/16	3/8 to 7/8
4/10	3/10	2/10

4/10	3/10	2/10
1 1/8 × 1/8 and 3/16	1/4 and 5/16	3/8 to 1
1 1/4 to 4 1/2 × 1/4 and 5/16, / " × 1 1/8 to 2		2/10
4 3/4 to 6	3/8 to 1,	
4 3/4 to 6	1/4 and 5/16,	
"	1 1/8 to 2,	
6 1/4 to 7	3/8 to 1	4/10
2 1/4 to 3	2 1/8 to 2 1/2	
6 1/4 to 7	1/4 and	
"	1 1/8 to 2	6/10
3 1/4 to 4	2 1/8 to 3	

Ovals.

8/10	6/10	4/10	2/10
1/2 and 9/16	5/8 and 11/16	3/4	7/8 & up.

Half Ovals and Half Rounds.

1 2/10	1 1/10	8/10	4/10
1/2 and 9/16	5/8 and 11/16	3/4	7/8 and up.

Ulster Horse Shoe. - - 3 5/10

MISCELLANEOUS.

Special Rates Given On Application.

Iron and Steel Rails; Railroad Chairs and Spikes; Railroad Fish Plates; Bolts, &c.; Railroad Axles and Wheels; Wire Rods; Screw Rods; Gas and Steam Tubes; Nails; Rivets; Tank Iron. Wrought Iron Beams, Deck Beams, Channel Bars, Star Iron, Octagonal Post Iron, "Upset" Chord Bars; Angle and Tee Iron.

"Universal Mill" Plates.

Plates not over 24 in. wide, × 3-8 to 7-16
Plates not over 24 in. wide, × 1-2 and upw'ds
Plates not over 24 in. wide, × 3-16 to 5-16.

All plates over **30** feet long, weighing **1000** lbs. or over, subject to **special agreement only.**

These Plates are not Sheared.

Edges guaranteed perfectly solid, straight and of uniform width, rendering reshearing unnecessary when exactness is required.

PICKS,

Our own manufacture of Railroad, Drifting, Poll, Coal and Mining Picks. Also

CROW-BARS

of all kinds.

STEEL,

Foreign and Domestic.

English	Cast Steel,	15c
"	Spring Steel,	6
"	Tire "	6
"	Toe Calk Steel,	6
"	Machinery Steel,	9
"	Bessemer Wire Rods,	
American	Bessemer Tire Steel,	
"	3-16 up,	5c.
"	" " " 5-32 up.	5 1/4
"	" " " 1-8 "	5 1/2
"	" " " 3-32 "	5 3/4
"	Spring Steel,	5
"	Tool "	13
"	Machinery Steel,	7
"	Toe Calk Steel,	5
"	Plow Steel,	6
"	Sleigh Shoe Steel,	4
"	Bessemer Steel,	7
"	Steel Crowbars,	6 1/2

STEEL FORGINGS TO ORDER.

REVIEW.

Within the past month our market has improved, and concessions made before then could not be obtained now.

The advance of freights—the failure of several mills who have been selling at lowest prices—the general refusal of responsible mills to sell at the late low figures—the placing of some large orders for our transit railroads, and a more confident feeling generally concerning the future have all combined to stiffen prices.

While for some time there will probably be no great advance and no great temptation for speculation, we believe that prices will not alone be better maintained, but will be more remunerative and satisfactory to all concerned.

PIERSON & CO., 24 Broadway.

AMERICAN MACHINIST.

(CIRCULATION 5,000 COPIES.)

A journal for Machinists, Engineers, Founders, Boiler Makers, Pattern Makers and Blacksmiths.

Published Monthly at 88 Warren Street, N. Y.

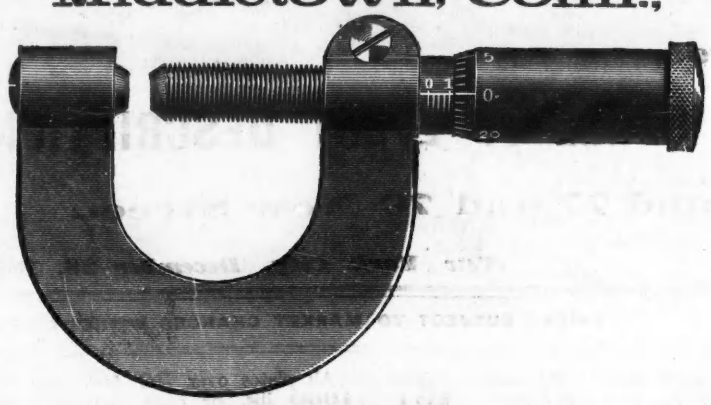
BY

MILLER & BAILEY, **Editors and Proprietors.**

Subscription $1.50 per year, post-paid, to any address in the United States or Canada.

☞ "The want which this new paper has undertaken to fill is one which has long been felt in this country, and in which abundant success awaits the enterprise which supplies the want."—*Railroad Gazette.*

VICTOR SEWING MACHINE COMPANY,
Middletown, Conn.,



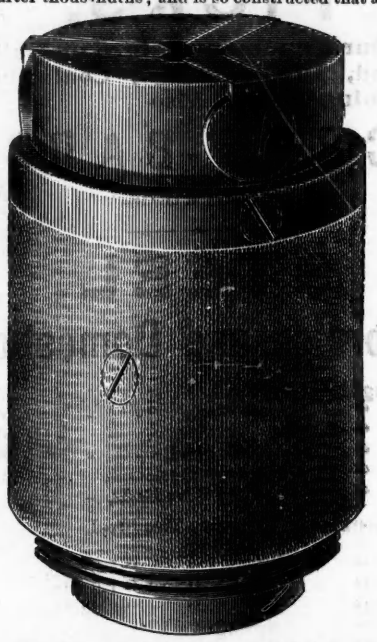
MANUFACTURERS OF THE

MICROMETER CALIPER.

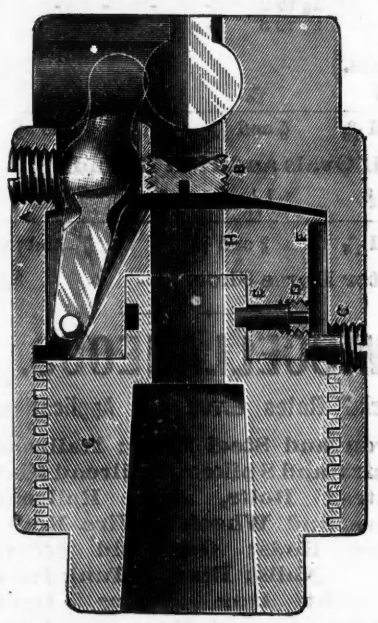
Price, $5. In Morocco Case, $6.

This attractive and very desirable tool will be found more reliable and convenient than the Vernier Caliper, and to Machinists and Tool-makers it is indispensable on work requiring very accurate and close measurement. *This feature is guaranteed.*

Its capacity is one inch, and is graduated to one-thousandths, but can readily be set one-half and quarter thousandths; and is so constructed that any wear resulting from use can be readily adjusted.

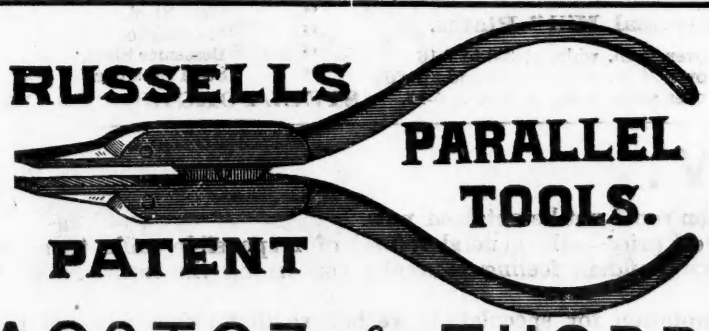


Victor Chuck, price $8.50.



We also manufacture the "VICTOR" CHUCK, which has the commendation of accomplished machinists as possessing superior qualities. It is adjustable, self-tightening, and the clutches being flush with the face, renders it more convenient for the workman than any other, and less liable to be broken.

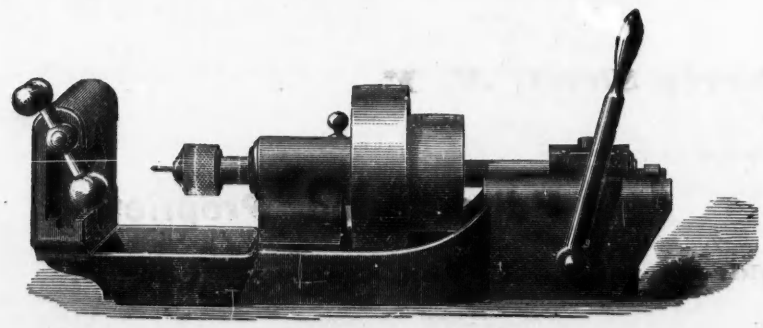
RUSSELLS PARALLEL TOOLS.
PATENT



HAGSTOZ & THORPE,
Sole Manufacturers.
Sixth and Chestnut, PHILADELPHIA.

The Bullard Machine Co.,
(LIMITED.)

No. 14 Dey St., N. Y.



Dealers in Machinists' Tools, Wood Working Machinery and Steam Engines.

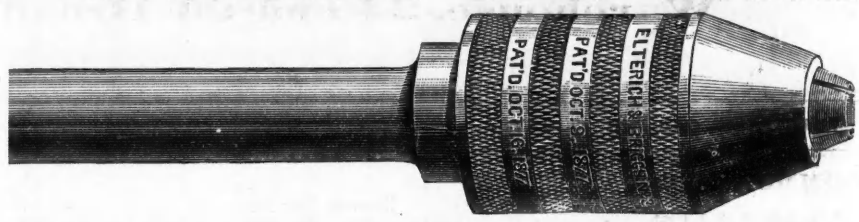
Manufacturers of Bullard's improved Centering Machine.

First-class Second-Hand Tools and Engines a specialty. Cash paid for good second-hand tools. Correspondence solicited.

FRASSE & COMPANY,
62 Chatham Street, New York,
P. O. Box, 4627.

SOLE AGENTS FOR

The Elterich Drill Chuck.



This Chuck holds a drill in such a manner that it is impossible for it to slip, thus compelling it to do its work as long as the power continues to drive it.

We are prepared to furnish a full assortment of Fine Tools, Files, Steel Wire and supplies for Machinists, Blacksmiths, Brass Finishers, Gunsmiths, Locksmiths, Telegraph, Optical Instrument and Sewing Machine Manufacturers.

Peter Stub's Bright Round Steel Wire, Bar Steel, Tools and Files,

Grobet, Vautier and Borloz Swiss Files.

Turning Lathes, Slide Rests, Chucks and Twist Drills, Taps and Dies, &c. &c.

SYNOVIAL
Lubricating Oil

THE MOST

DURABLE, RELIABLE,

AND

Economical Lubricant

IN EXISTENCE.

Applicable to every grade of Machinery.

Manufactured Exclusively by the

LESTER OIL CO.,
81 MAIDEN LANE,
New York.

SEND FOR CIRCULAR AND PRICE LISF.

ALMOND
DRILL
CHUCK

Made of Steel throughout equal to doing any work required of it—Runs perfectly true. Cost but $5.

T. R. ALMOND
84 Pearl St.
BROOKLYN.

Pond's Tools,
Engine Lathes, Planers, Drills, Etc.,

Send for Catalogue. DAVID W. POND, Successor to LUCIUS W. POND, Worcester, Mass.

THERON SKEEL,
ENGINEER,
149 Broadway,
NEW YORK.

Will furnish plan and specification for and will superintend the construction of steam machinery of all kinds, including, steam boilers, pumping machinery, warming and ventilating apparatus for churches, hospitals, etc. Hydraulic elevators for warehouses or passengers, engines and boilers for steam yachts.

Will examine and report upon the condition or performance of machinery for parties wishing to purchase.

Will experiment upon and remedy defects in engines and boilers, for parties either short of steam or wishing to save coal.

RICHARD DUDGEON,
24 Columbia Street,
NEW YORK.
Maker and Patentee of
IMPROVED HYDRAULIZ JA KZ,

Punches and Roller Tube Expanders.

and

DIRECT ACTING STEAM HAMMERS

Communications by letter will receive prompt attention.

Jacks for Pressing on Car Wheels or Crank Pins made to order.

Daniel T. Ames

PEN ARTIST,
AND PUBLISHER OF THE
Penmans' Art Journal,
205 Broadway, N. Y.

Executes every class of Pen Work in the best style of the Art.

Drawings for Photo-Engraving and Photo-Lithography a Specialty.

Pattern Letters,

E

ALL SIZES,
From ⅛ inch up to 6 inches.

The peculiar features of my Letters are uniformity of Bevel, Symmetry and Proportion combined harmoniously.

N

Wil Cast in Iron as Fine as Type.

Founders and others can be immediately supplied at whole sale rates by return of mail.

100 different sizes and kinds

Illustrated catalogue sent on application. Address

E

S. E. ADAMSON,
3 Park Place, NEW YORK.

L. SMITH HOBART, President. JOHN C. MOSS, Superintendent.

NEW METHOD OF ENGRAVING

Moss' Process.

Photo Engraving Co.

67 Park Place, New York.

RELIEF PLATES

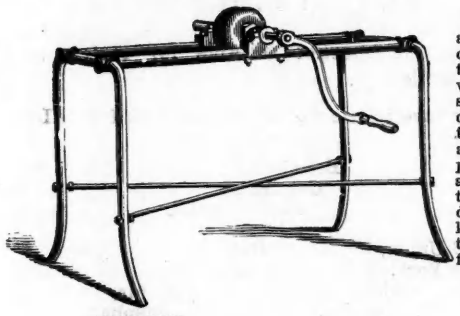
For Newspaper, Book and Catalogue Illustrations, Engraved in Type-metal, by a new Photo-Chemical method, from all kinds of Prints, Pen Drawings, Photographs, Original Designs, &c., MUCH CHEAPER THAN WOOD-CUTS These Plates have a perfectly smooth printing surface, and the lines are as deep, as even, and as sharp as they could possibly be cut by hand. We guarantee that they will print satisfactorily on wet or dry paper, and on any press where type or wood-cuts can be so printed. Electrotypes may be made from them in the usual way.

Our Plates are now used by the principal publishers and manufacturers in every State in the Union.

SEND STAMP FOR ILLUSTRATED CIRCULAR.

Tubular Iron Grindstone Frames.

J. E. Defreest's Patent.



These Grindstone Frames are made of Gas Pipe, are light but very strong, the parts are made interchangeable, and by removing the two brace rods the legs can be folded together, so that the Frames will not require the usual room for storage and shipping that wood or cast iron frames do; they are cheaper, lighter, stronger, and far more durable than cast iron, and can be shipped or forwarded at a much less expense for freight charges, and no possible danger from accidental breakage; they are adapted for either power or hand use, and are particularly desirable for warm latitudes where wood decays so rapidly. Our price for them is much below that for cast iron frames, and not much above that for good wood frames. We furnish them ready for use or properly packed for shipment.

For imformation in regard to above,

ADDRESS

TORRANCE, MERRIAM & CO.,

TROY, N. Y.

Manufacturers of Malleable and Grey Iron Castings of Superior Quality.

Established 1852.

Torrance, Merriam & Co.,

MANUFACTURERS OF

MALLEABLE AND Small Grey Iron Castings,

OF SUPERIOR QUALITY,

TROY, N. Y.

The Sabbaton Malleable Iron Coke and Coal Shovels.

Orders Solicited. Illustrated Catalogues sent on Application.

These shovels are made of best Malleable Iron, are very strong and durable, and are great labor-saving coal and ash screens. Every factory, foundry, machine shop, or other place where coal is used in any considerable quantity, should have one or more of these shovels.

Send for price list.

AMERICAN IRON WORKS.

JONES & LAUGHLINS,

PITTSBURGH, PA.,

MANUFACTURERS OF

AMERICAN AND CLAIR:

BAR, HOOP, SHEET and PLATE IRON,
BRIDGE IRON,
ANGLE IRON,
PLOW BEAM IRON,
GAURD IRON,
COAL SCREEN IRON,
CUT NAILS and SPIKES,
SHIP and BOAT SPIKES,
RAILROAD SPIKES,
T RAIL, 8, 12, 16, 20, 28, and 40 lbs. to yard,
STREET RAIL, 23, 27, 32 and 45 lbs. to yard,
TRAM RAILS, punched and countersunk,
RAILROAD FISH BARS and BOLTS,
COAL PIT CAR WHEELS and AXLES,
PATENT COLD ROLLED SHAFTING,
PATENT COLD ROLLED PITONS RODS,
FINGER BARS and KNIFE BACKS,
PULLEYS, HANGERS and COUPLINGS.

WAREHOUSE AND OFFICE

Second and Third Aves., and Try St.

BRANCH OFFICES

Nos. 190 to 196 South Canal Street,
CHICAGO, ILL.

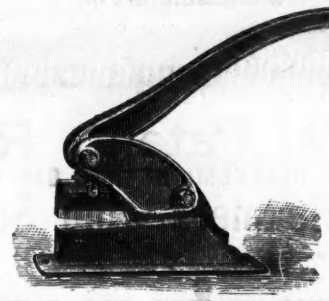
Nos. 133 to 139 West Water Street,
MILWAUKEE, WIS.

W. M. B. HAMMOND & CO.,

34 Warren Street, N. Y.,

EXPORTERS of all kinds of

AMERICAN MANUFACTURES.



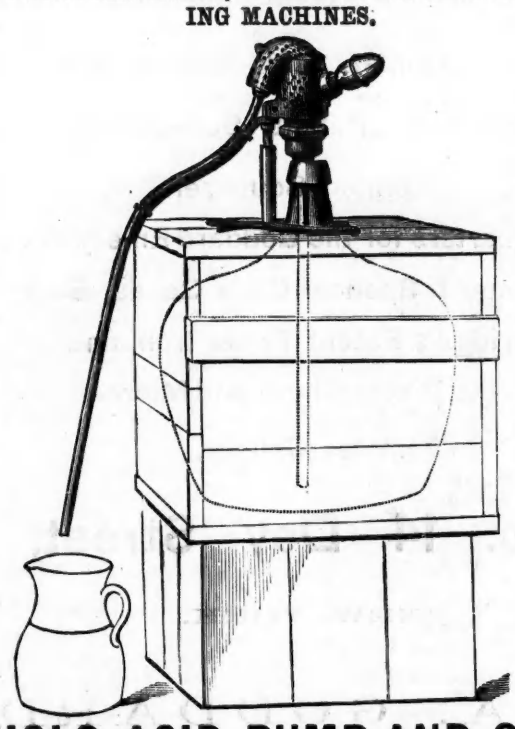
SPECIAL ATTENTION GIVEN TO THE

Introduction OF SPECIALTIES IN Foreign Countries

Representing HORIZONTAL AND UPRIGHT DRILLS, OLD COLONY IRON CUTTERS AND PUNCHES, HAND SHAPING AND PLANING MACHINE, KNOX FLUTING MACHINES, THE ASTOR & CHAPMAN'S PLAITING MACHINES.

Stockton Paper Ware Co.,

Kimbal Patent Shovels.



Emery and Hardware Generally.

Malleable and Grey Iron Castings

WASHINGTON MILLS

NICHOLS ACID PUMP AND SIPHON,

BOXED FOR SHIPMENT, $10.00.

NEWARK STEEL WORKS.

Benjamin Atha & Co.,

Manufacturers of

CAST STEEL.

We make grades of steel specially adapted to the manufacture of Lathe Tools, Chisels, Taps and Dies.

NEWARK,

NEW JERSEY.

BENJ. ATHA. J. ILLINGWORTH.

H. PRENTISS & CO.,

Manufacturers of

Goddard's Patent Relieved

MACHINISTS' BLACKSMITHS' AND GAS FITTERS'

Taps; Dies, Reamers and Screw Plates.

The Bee Gimlet and Brace Bits, and Sammis' Patent Self-cutting Lemon Squeezer.

Head-quarters for the Goddard Emery Wheel Billings & Spencer Co.'s Goods, Burbridge's Patent Tweer Iron, and the Victor Chuck and Micrometer Caliper.

No. 14 Dey Street,

NEW YORK.

E. A. GODDARD,

GENERAL SALES AGENT.

John H. Thompson & Co.,

Furnace Agents for

Standard Brands

AMERICAN PIG IRON.

P. O. Box 163. 32 Pine Street, N. Y.

The Pratt and Whitney Co., Hartford, Conn.

This Set of Screw Cutting Tools to cut 5-16 to 1-4 inch, $25. Dies cut clean full threads in once passing over a bolt.

Presses, Drop Hammers, Dies and other Tools,

FOR THE MANUFACTURE OF ALL KINDS OF

SHEET METAL GOODS,

DROP FORGINGS, &c.

THE

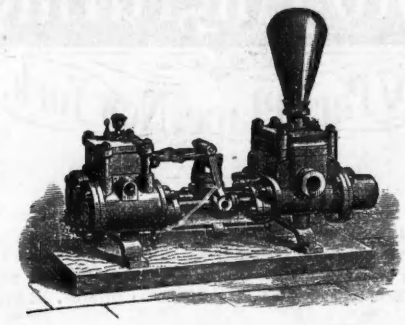
Stiles and Parker Press Co.,

MIDDLETOWN, CONN.

Reading Hydraulic Works,

MANUFACTURERS OF THE

HARRIS PUMP,



GENERAL SELLING AGENTS OF

H. R. WORTHINGTON'S

Steam Pumping Engines

SINGLE and DUPLEX, PORTABLE and SEMI-PORTABLE.

We sell the only NOISELESS Pump in the Market suitable for Hotels and Public Buildings.

The following Hotels in New York City have in use the WORTHINGTON DUPLEX PUMPING ENGINES:

Albemarle, Astor, Brandeth,
Buckingham, Clarendon, Coleman,
Continental, Everett, Fifth Avenue,
French's, Gilsey, Glenham,
Grand, Grand Union, Hoffman,
Metropolitan, New York, Prescott,
Rossmore, St. Charles, St. Dennis,
St. James, St. Nicholas, St. Stephen,
Sinclair, Stevens, Union Square,
Westminster, Windsor, Rockingham,
Webb's.

Pumps can be seen in operation at our Warerooms,

87 LIBERTY. STREET, N. Y.

FREELAND TOOL WORKS.

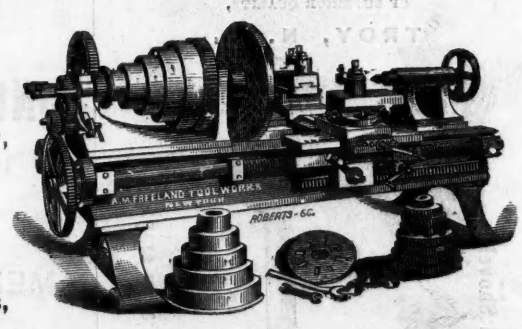
THOMAS & CO.,

558 and 560 West Thirty-fourth Street,

NEW YORK CITY,

MANUFACTURERS OF

Machinists' Tools,
Mining, Hydraulic and Experimental Machinery,
Patent Office Models,
Surface Plates,
Standard Guide Screws and Special Tools,



ALSO MANUFACTURERS OF

Thomas's Patent Planer Vise,

THE BEST IN THE WORLD. SEND FOR CIRCULAR.

Townsend & Preston,

Successors to JOS. TOWNSEND.

MACHINIST,

Manufacturer of

Foot and Power Lathe with Screw cutting attachment, for Slide Rest Presses, Tops, Dies and Tools of all descriptions.

Special Machinery Made to Order.

182 Centre Street,

New York City.

The undersigned as successors of the late JOSEPH TOWNSEND, will continue to carry on the business heretofore carried on by him for nearly a quarter of a century and use the same machinery with many valuable additions and improvements in manufacturing and improving on the above and will do their utmost to keep up the reputation established by the late JOSEPH TOWNSEND, and strive to give entire satisfaction to their patrons. The Lathes manufactured by us were on exhibition for the first time at the American Institute, and we take pleasure in announcing to the public that the officers of the Institute, after a careful inspection of our Foot Power Lathes, awarded us the Medal of Superiority for them.

A. M. TOWNSEND. JAMES PRESTON.

We are now prepared to furnish these goods at very much lower prices than formerly.

Send for our prices.

WORCESTER MACHINE SCREW CO.,

Worcester, Mass., or 111 Liberty St., N. Y.

STONE AND HAZELTON

13 Bowker St., Boston,

Manufacturers of Improved Specialties for Machinists,

Spring Chuck Lathes, Combination Turning and Screw Tool. Chaplin's Patent Power Planer, Improved Caliper Square. ☞ Send for Circular.